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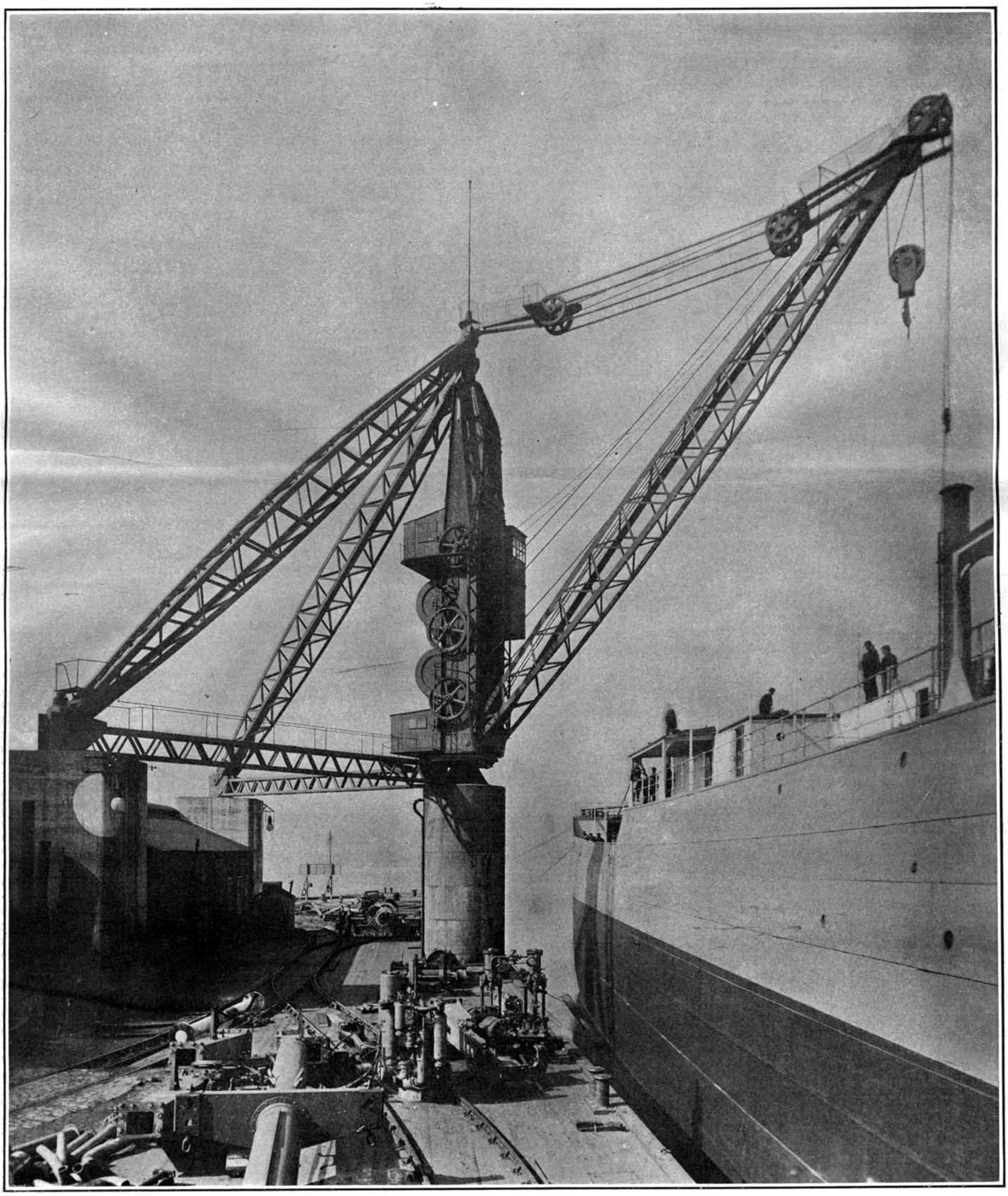
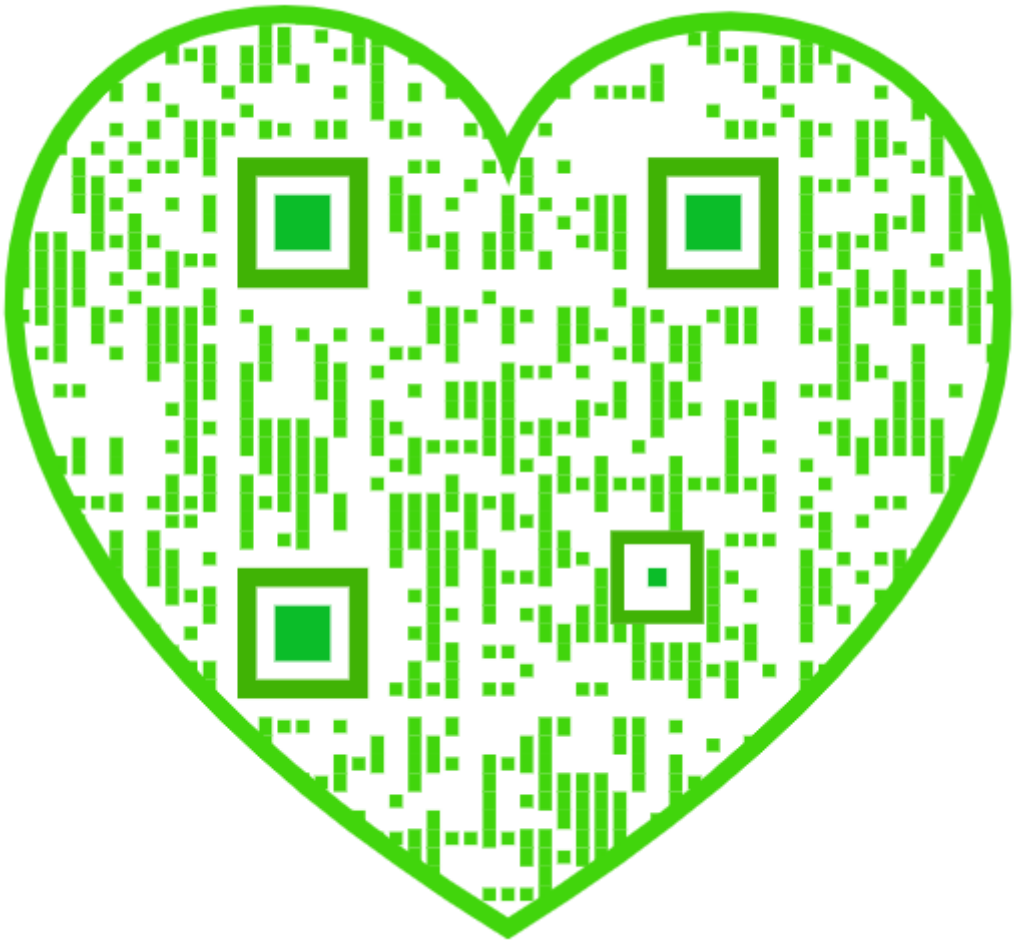


A ONE-HUNDRED-TON ELECTRIC CRANE USED IN A SCOTCH SHIPYARD.—[See page 515.]



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NEW YORK, SATURDAY, JUNE 23, 1906.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

PRESENT CONDITION OF THE ASSOUAN DAM.

In view of the fact that persistent reports have been circulated to the effect that the Assouan dam is being undermined by the rush of the water through the sluices, and, further, that the impounded reservoir has not improved the agricultural conditions of Egypt in any proportion to the great outlay of capital which has been made, the latest report of Lord Cromer on the condition of Egypt comes as a very effective denial of both statements. He dwells upon the material benefits which have accrued to Egypt as the result of the operation of the reservoir during the year 1905. Had it not been for its existence, the country would have been in a poor way because of the shortage of last year's flood; but by skillful regulation of the sluices, the impounded water was so distributed that the area of cultivated land that was left unwatered was comparatively small, less, indeed, than during the low flood of 1904.

As regards the cavities and depressions which have been cut out by the rush of water through the sluices, and which it was said must ultimately cause a large section of the dam to overturn about its toe, we learn that these washouts have been entirely filled up with solid granite masonry set in cement mortar. This work has been carried up to the level of the sills of the sluices, and its surface falls on an easy grade until it meets the natural rock surface nearly 200 feet downstream from the dam. The water has been flowing over this new masonry at great velocity since August last, and it has stood the rush of waters without any signs of failure. The report announces that since the completion of this work any doubt as to the stability of the dam is entirely removed. The question of raising the dam to a greater height is still under discussion.

TRANSATLANTIC WIRELESS TELEGRAPH TROUBLES.

In the years that have elapsed since Marconi startled the world with the statement that he had transmitted a wireless message from England to America, a large amount of experimental investigation has been carried on, with the object of determining the laws which govern this most fascinating of modern discoveries. It was natural enough that, when he had proved the possibility of wireless communication over three thousand miles of ocean, even though the message consisted of a single letter ever so faintly heard at the receiver, Marconi should have supposed that for the transmission of regular commercial messages all that was required was apparatus of greater height, capacities of greater area, and the installation of sending apparatus of larger power. Costly stations were equipped on this supposition both in Cornwall, England, and on the Atlantic coast, and an actual message was transmitted from President Roosevelt to King Edward. That was in January, 1903, and in the following March the Marconi Company undertook to furnish the London Times with daily wireless dispatches from the United States. These, however, were discontinued after only a couple of dispatches had been sent, and to those who were following closely the progress of the art, it soon became evident that, although the transmission of a full message had been proved to be possible, there must be certain atmospheric or other conditions affecting transatlantic wireless telegraphy, which would have to be understood and met before it would be possible to maintain a regular service free from interruption.

Meanwhile other investigators who had been doing good work in the field of wireless telegraphy on a less ambitious scale, were beginning to turn their attention to the great problem which Marconi had so boldly attacked, and with such promising initial success; and ultimately De Forest and Fessenden established stations in which elaborate experimental work has been carried on continuously. Both of these gentlemen claim to have succeeded in establishing transoceanic communication, and Prof. Fessenden has recently broken through the reticence that has characterized investigation in this field in the past, and has contributed to the Electrical Review, of London, an article in which he gives a very frank statement of the work which he has accomplished, and the obstacles which must be overcome before it will be possible to establish an absolutely reliable service free from interruption. The distance between the Fessenden stations at Brant Rock, Mass., near Boston, and Machrihanish is about 3,000 miles, and under favorable conditions messages are exchanged without any difficulty. It has been found, however, that the ability to send messages varies very greatly, not only on different days, but even during different parts of the same day; and Prof. Fessenden has found that on certain days the signals received were of five hundred times greater intensity than other messages sent out under apparently similar conditions on other days. From this it follows that to make certain of being able to transmit messages on any day of the year, the apparatus must be built to correspond to the days of least intensity; or, in other words, a "factor of safety" of at least 500 must be adopted. The problem might be attacked, either by providing an increase of sensitiveness in the receiving apparatus, or an increase in power at the sending station, and in all probability both means will be adopted. On the other hand, if an intensity of transmission be used which is sufficient to meet the worst conditions, it may be found that on the days when conditions are favorable to transmission, such intense signals would be detrimental. Not only might they injuriously affect the operation of other stations, but they might even interfere with the station at which they were directed; for Prof. Fessenden has noticed during his transatlantic tests what he has called an "echo signal," that is, a signal coming about one-fifth of a second later than the main signal; and he believes that this second signal reaches the receiving station later because it goes the longer way around. If transmission of great intensity were used, these echo signals might become loud enough to have a confusing effect at the receiving station. Transmission conditions must be tested frequently in order to determine the proper intensity for current use, for the changes in conditions affecting transmission take place with some rapidity.

As for the causes of these rapid changes, it was pointed out some time ago by Prof. Fessenden that not only is one of the causes to be found in the action of sunlight, but that there appear to be in the atmosphere large masses of absorbing material which considerably reduce the intensity of the transmission. These masses vary in size and in the height above the sea level at which they exist. They appear to be nearer sea level in the tropics, where long-distance transmission is more difficult than in the temperate zone, and in some cases the absorption by these masses is found to be so great as to leave only about one-tenth per cent of the energy of transmission available. Another effect of which the cause has yet to be found, is that messages at certain times can be transmitted more easily in an east and west direction than in one north and south; moreover, there are indications that diffraction takes place. It is considered that both of these effects may be due to the shifting of the position of the so-called absorbing masses, which are supposed to be the most serious obstacle to transatlantic transmission.

THE INFLUENCE OF INCREASED BAROMETRIC PRESSURE ON THE HUMAN BODY.

A series of interesting experiments for determining the influence of the varying atmospheric pressures upon the human system have been carried out by two English scientists, Mr. Leonard Hill, F.R.S., and Mr. M. Greenwood, Jr., M.R.C.S., under the auspices of the Royal Society of Great Britain. These experiments are of particular importance owing to recent extensive engineering works which depend largely on caisson working and deep-sea diving. During the past few years numbers of mechanics employed in caisson operations have developed symptoms of paralysis of the muscles after prolonged immersion in the working area at abnormal atmospheric pressure, and to this malady the term "caisson disease" has been applied. It was with the object of ascertaining the cause of this complaint, and also with the purpose of determining the greatest depth at which a diver can work with safety, that Messrs. Hill and Greenwood conducted their investigations.

From the results of previous experiments carried out by Mr. Hill upon animals, he discovered that every 100 cubic centimeters of blood or tissue fluid dissolved at body temperature about 1 cubic centimeter of nitrogen under one atmosphere of air, 2 cubic centimeters under two atmospheres, and so on. When the decompression period is accelerated, the nitrogen is set free as bubbles in the capillaries and tissue spaces, and by the resultant embolism of some vessel in the body, symptoms varying in nature and intensity are liable to be produced. The usual working shifts of caisson mechanics range from two to four hours, and in this time the body fluids of the men become saturated with nitrogen.

Mr. Hill ascertained that no ill effects were experienced by animals when exposed to pressures up to seven atmospheres, provided a period of 20 minutes was allowed to each atmosphere for decompression. He thereupon resolved to ascertain personally the effects produced upon the human system under varying pressures. The apparatus employed by Hill and Greenwood consisted of a large steel cylinder of 42.2 cubic feet capacity fitted with a mattress, blanket, and pillows, upon which the subject could recline in a comfortable position. The interior was electrically illumined, and by means of the telephone and electric bell the subject was able to communicate with his companion outside. A two-cylinder motor-driven pump was used for compressing the air, and this was capable of raising the air pressure within the cylinder to six atmospheres in approximately 40 minutes. There were two decompression pipes with taps of fine bore, so that the rate of escape could be very finely adjusted. In order to avoid any accumulation of carbon dioxide gas, a constant ventilation was maintained.

In one of the tests Mr. Greenwood, upon emerging from the chamber, experienced itching in both forearms, more especially in the right. At first the pains were light, but after a lapse of about 20 minutes they increased, becoming neuralgic in character. After remaining moderately intense for five minutes, they gradually subsided. Later investigations indicated that the pains were due to the fact that the subject remained practically motionless during the period of decompression.

In the course of the investigations pressures ranging up to 92 pounds were attained. In no instance were any severe after-effects experienced. A pressure of 90 pounds is equivalent to a water depth of 210 feet, which is some 90 feet in excess of the safety limit fixed by the British Admiralty for divers. It is thus evident that an adult may be safely submitted to a total barometric pressure of seven atmospheres. Even a greater depth than 210 feet might be attained, since the limit appears to be fixed by the pressure at which the toxic effects of high-tension oxygen become an immediate danger. These toxic effects have been closely studied by several scientists. When the partial pressure of oxygen reaches two atmospheres, corresponding to ten atmospheres of air, or a depth of 350 feet in water, convulsions may occur in animals within 20 minutes. It is possible that this limit may be extended by diluting the air with nitrogen, but upon this point the investigators do not claim to afford any testimony. However, the results of their practical observations show that the diving depth may be safely increased up to 210 feet.

The observers prepared a careful record of the various sensations they experienced under pressure. The feeling of discomfort in the ears, due to a different air pressure on opposite sides of the tympanum, is well known. Previous to the experiments Mr. Hill had not practised the opening of the Eustachian tubes, and the effect of the test was most disturbing. When, however, the method of opening these tubes had been explained to him, he experienced no further trouble. The power of hearing appeared to be much more acute when the subject was under pressure. The signal of a tap with a spanner upon the outside of the cylinder was heard with painful intensity. The change in the voice which is so well known among caisson workers was well marked during these trials. The voice assumed a peculiar nasal and metallic quality, and the individual characteristic tones were lost. At three atmospheres the power to whisper or whistle was almost entirely lost, and this loss of the vibratile movements of the tongue and lips was a result due probably to the damping effects of the dense air. One of the most important results obtained by these experiments is the imperative necessity of moving every muscle and joint in the body during the period of decompression, and this for the purpose of keeping the capillary circulation active in every part. In the brain, spinal cord, and abdominal organs, this circulation is kept active by the work of the respiratory pump. In the limbs, muscles, fat of the back and chest, the movement of the blood and lymph back to the heart depends mostly on changes of posture and the expressive action of contracting muscles. In one test Mr. Greenwood was decompressed from 75 pounds in 95 minutes, and during this period he flexed and extended all the limb joints at frequent intervals, with the exception of the knees. A little while after leaving the chamber no pains or stiffness were felt, except in the knees, which had not been exercised. In another test Mr. Hill was decompressed from five atmospheres in 105 minutes, a pause of five minutes being made at each atmosphere. During the decompression the muscles of the limbs and back were regularly moved, and the only part of the body which the subject omitted to move and massage was the front of the chest. In the evening of the day of the experi-

ment painful places were felt in this region, and a peculiar purplish rash appeared. Forty-eight hours after the test this rash was still discernible. The opinion of the investigators on this point is that the rash was attributable to small bubbles embolizing the vessels of the subcutaneous fat, while in the case of Mr. Greenwood the pain experienced was probably caused by small bubbles in the nerve sheaths in the first case, and in the knee joint in the second instance. The imperative necessity of active movement during decompression is thus shown, and caisson workers should be instructed to freely exercise and massage every part of the body while undergoing decompression in the air lock.

THE INDUSTRIAL USES AND VALUE OF ALCOHOL.

BY HENRY HALE.

The decision of the government to permit the manufacture and sale of ethyl alcohol free of any tax where it is denaturized, or rendered unfit for use as a beverage by treating it with some suitable denaturant, is of the highest importance to this country, owing to the effect it will have on so many different industries. While the number of plants for the manufacture of alcohol will undoubtedly be greatly increased, its benefit in other forms of industry is of far more moment.

It is needless to more than refer to the raw material from which alcohol can be produced at such a small expense that it can be utilized in place of refined petroleum and other liquids to a greater advantage. As corn is one of the principal materials, a brief reference to the quantity of spirits which can be secured from this grain may be given. Tests which have been made at distilling plants in Illinois show that from one bushel of corn no less than five gallons of proof alcohol can be distilled. This means a liquid which is from 90 to 95 per cent pure and from 185 to 190 degrees proof—a standard which allows it to be utilized in nearly every product in which it is required as an ingredient, and which shows it to be superior to gasoline and kerosene as a fuel and as an illuminant. Estimating the cost of a bushel of corn at 42 cents, the entire expense of a gallon of this alcohol is but 10.78 cents, for with the modern equipment of a distilling plant the cost of mechanical treatment is actually less than two cents per gallon. According to recent statistics compiled by the government, crude wood alcohol costs no less than 40 cents per gallon to manufacture. As low-grade molasses from sugar cane is another base for the spirit, reliable data have been obtained as to the percentage which a given quantity of it will yield. The Cuban distilleries extract a gallon of alcohol (which is 90 per cent absolute) from two gallons of the molasses—molasses of a quality which is brought to this country and sold at three cents a gallon. The average expense of manufacture, based on this price for the raw material, is less than 10 cents. The difference between the molasses and corn spirit is that the former has an odor which is somewhat disagreeable, but it can be utilized as effectively as the other for all purposes except in preparation of liquors and medicines. The low cost of the molasses alcohol is of much significance, as this base is similar to the waste product obtained in the manufacture of sugar from beets. Consequently, it should be an additional incentive in the expansion of the beet-sugar industry, while an opportunity is offered to manufacture alcohol especially in Louisiana and Hawaii.

As is well known, potatoes and fruit are two other inexhaustible sources of supply in this country. The importance of the potato as an alcohol producer can be appreciated when it is known that 20 per cent of its substance represents alcohol, and that an acre of potatoes yielding 300 bushels will supply over 250 gallons. At present the aggregate American potato harvest exceeds 200,000,000 bushels, grown practically in every part of the United States. Overripe fruit, which is now largely a waste product in the various orchard districts, can be utilized in the same manner.

As ethyl alcohol can be employed to greater advantage than the methyl spirit in nearly every branch of manufacture in which alcohol is an essential, some of the products in which it will be utilized extensively may be mentioned. They are as follows:

Aniline colors and dyes; hats (stiff, silk, and straw); electrical apparatus; transparent soap; furniture; picture moldings; burial caskets; cabinet work; passenger cars; pianos; organs; whips; toys; rattan goods; lead pencils; brushes; wagons; boots and shoes; smokeless powder; fulminate of mercury; brass beds; gas and electric-light fixtures; various kinds of metal hardware; incandescent mantles; photographic materials; celluloid and other like compounds; sulphuric ether and organic chemicals.

Nearly every one of these represents material extensively used in this country as well as in Europe. The manufacture of aniline dyes, however, has been greatly handicapped for the reason that Germany, permitting the use of tax-free alcohol, has become the great center of the industry, as the spirit is one of the main essentials. At present only 200 barrels of grain alcohol are used yearly for this purpose in the United States. In the making of hats about one-half gallon of ethyl or methyl spirit is needed to every half dozen, which will give an idea of the extent it is used in this industry. Its value in finishing woodwork, such as furniture and pianos, lies in the fact that it is the best solvent for shellac, and is indispensable as an ingredient in the preparation of fine varnishes and polishes. It is an interesting fact that solutions of shellac and alcohol enter largely into the manufacture of hats, and are used also as a lacquer for the coating of polished metalwork. In modern explosives alcohol is required in such quantities in the preparation of fulminates and smokeless powders, that here again some of the European nations have had the advantage of us, since they have been enabled to secure supplies of ammunition at a much smaller cost. Tax-free alcohol is therefore of vital importance to the country from a military point of view. Most of our fulminates, for example, are made in Canada from American alcohol and returned to the United States to be sold.

The popularity of illumination by means of the incandescent mantle has caused this device to be made literally by the millions. From one plant alone in Camden, N. J., come 15,000,000 mantles a year. The spirit required by this company is about 50,000 gallons. In the past it has largely consisted of wood alcohol mixed with cotton especially treated to form a coating which protects the mantle while being handled. It is this coating which is "burned off" when the mantle is placed upon the fixture for service. In chemical solutions for photographic work, and for the artificial drying of negatives and prints, grain alcohol may be considered invaluable. Substitutes have been employed for it to a large extent in America, but the price of such articles in Europe averages considerably lower than in this country, owing to the higher grade of spirit which can be employed tax-free. As an indication of the enormous quantity of inferior substitutes utilized in place of ethyl alcohol at present, the report of the Commissioner of Internal Revenue shows that during 1905 less than 175,000 gallons of ethyl spirits were used by American manufacturers of aniline dyes, soap, woodwork, photographic material, celluloid, and electrical apparatus. Prior to 1862, when the internal revenue law, which has been abolished, went into effect, the annual production of this grade of alcohol was 90,000,000 gallons, of which a large percentage was consumed in industries exclusive of the preparation of beverages.

Thus far reference has been made only to some of the minor ways in which grain alcohol will take the place of other fluids when the tax upon it is removed. Unquestionably, its importance as a factor in producing light, heat, and power is of the greatest magnitude. Indeed, it promises to become one of the main elements for illumination in the United States, not excluding petroleum, gas, and the electric lamp, for the light produced by it is of a very high quality. We have been chiefly familiar with the small taper used in the sick chamber, where the expense of buying alcohol at 40 and 50 cents a pint for this purpose could be met. With a flame of intense whitness, almost free from odor, the spirit lamp has recommended itself to physicians and nurses. To illustrate its advantage over kerosene and other forms of illuminating oils, a French inventor has perfected a lamp which burns alcohol in connection with a Welsbach mantle. The alcohol is drawn by means of a wick into the burner, as in the example furnished by the ordinary kerosene lamp, by means of capillary attraction. In thirty seconds after being lighted the light is at its maximum brilliancy, unless it is turned down purposely. Tests which have been made with this type of lamp resulted in producing illumination equal to 25 candle-power for a period of 59 hours with a consumption of one gallon of alcohol. This quantity therefore sufficed for 1,475 candle-power hours. With the same quantity of kerosene and employing the same lamp, the illumination was equal to only 783 candle-power hours, the average candle-power of the oil light being but nine. Consequently, the total illumination furnished by the alcohol was nearly double that of the oil. The tests referred to were conducted by experts at the Electrical Testing Laboratories in New York. They agree with the statements of Prof. Rousseau, of the University of Belgium, that alcohol at 31 cents per gallon is more economical as an illuminant than kerosene at 15 cents per gallon, owing to its superior light-producing properties. Prof. Rousseau bases his argument on a series of photometric tests conducted at Brussels, when it was found that denaturized alcohol 90 per cent absolute would give this result. It has been shown in laboratory investigations that high-grade kerosene contains but 8,000 heat units per pound, while ethyl alcohol contains 12,000, thus being 50 per cent more productive of heat. As already stated, alcohol has been made from both corn and molasses, at a total cost not exceeding 12 cents a gallon. According to Prof. Rousseau's conclusions, a given quantity for lighting and heating purposes is equal to at least twice the quantity of highly-refined petroleum in the form of kerosene. As recent market quotations for the latter fluid at retail are from 15 to 20 cents per gallon, the fact seems to be verified beyond question that the spirit is preferable to the oil from the standpoint of economy, aside from the fact that it is without offensive odor, is less liable to ignition in handling, and gives a far better light or fuel where it is designed for cooking and other domestic purposes.

(To be continued.)

AUTOMOBILE NOTES.

The Automobile Club of America is planning to conduct an alcohol fuel consumption test next fall.

Simultaneously with the news that Percy Pierce finished the 1,000-mile Herkomer Trophy test with a perfect score for his Pierce "Arrow," word has been received that the 3,000-mile European circuit endurance test in which he is entered has been indefinitely postponed. Mr. Pierce will doubtless return at once to America in order to compete for the Glidden Trophy, which he was so successful in winning last year.

In order to test the energy consumption of electric carriages under unfavorable conditions, a 100 kilometer (62 mile) test run was recently organized in Paris over dirty and slippery roads, fog prevailing at the time. A number of carriages carrying four passengers, and weighing complete over 2 tons, covered the entire distance at an average speed of nearly 15 miles an hour, and consumed less than 160 watt-hours per ton mile. The first prize was gained by a carriage entered by M. Védrine, which required 155 watt-hours per ton-mile. According to L'Industrie Electrique, the energy consumption of this vehicle under ordinary conditions is from 110 to 120 watt-hours per ton-mile.

The leading automobile event of the season is to be the Grand Prix, organized by the Automobile Club of France, which will be run on the 26th and 27th of June upon a circular route known as the circuit of the Sarthe, not far from the town of Le Mans. The foreign automobile constructors have been making great efforts to surpass the cars which ran in last year's Gordon Bennett Cup race. As the list of entries has now been completed, we are able to give a list of the new cars which are to enter the race, and also some points about their construction. In the order of starting, we find the following makes: De Dietrich, Fiat, Renault, Darracq, Richard-Brasier, Mercedes, Gobron-Brillié, Itala, Gregoire, Panhard & Levassor, Vulpes, Hotchkiss, and Bayard-Clement. Three cars of each of these makes have been entered (excepting three) making 36 in all. The first series of 13 cars will be started, then the second and third, beginning at 6 o'clock A. M. We expect to illustrate some of the leading types at an early date. As to the main points of this year's cars, we find that chain and jointed rod driving are used in about an equal proportion, and none of the makers have changed their system. The gasoline tanks contain in general about 50 gallons, and the cars will all take on gasoline *en route*. About 15 or 20 gallons per 100 miles is expected for the consumption, this differing according to the power of the motors, the carbureters, the speed, etc. Special precautions are taken to re-fill the tanks as quickly as possible. Owing to the hard wear of the tires, the makers have been looking specially to this matter, and are to employ a rather light form, but very solid and having a great number of cloth layers. They are lessening the thickness, seeing that it is not the absolute wear, but the separation of the cloth that is to be feared in the circuit race. This year many of the new spring damping devices are used to deaden the shocks and jumping of the cars. The Truffault suspension is used on some of them, and also the new Eds spring damper. On the Panhard cars we find the progressive damper of Capt. Krebs, while the Renault cars have a liquid damper. This year the Mercedes cars use the Truffault suspension, and also a Jenatzy damper, which consists of a strong rubber band used to check the rebound. As to the carbureters, each maker uses his standard type, but some improvements have been made this year. In general, the wheels are larger than in last year's cars. This tends to diminish the wear of the tires, seeing that the latter will now have a lower speed. Most of the cars will have three gear speeds, but four will also be used on some of them. As to weight, the lightest cars are the Darracq and Gregoire, which weigh 1,900 and 1,980 pounds respectively. Most of the others are very near the limit of 2,240 pounds. The motor power is quite variable, and while the Richard-Brasier, Renault, and Gregoire motors have from 100 to 110 horse-power, the Itala, for instance, has 140 horse-power. With one exception, the chassis are built of pressed steel. One of the Gobron cars uses a steel chassis. All of this year's motors have four upright cylinders, and most of them are cast in pairs. Only the Bayard-Clement and the Panhard are using copper water jackets. The Gobron-Brillié motor continues to use a double piston in each cylinder. Italy, Germany, and France only are represented in the race. The Fiat and the new Itala cars will represent Italy and the Mercedes Germany.

ARTIFICIAL REGULATION OF ATMOSPHERIC HUMIDITY AND TEMPERATURE.

It is surprising that in an age which is remarkable for the rapid advance which has been made in sanitation and in all matters affecting the comfort of the individual in his daily life, so comparatively little should have been done to control the atmospheric conditions encountered in the various buildings—dwelling rooms, offices, factories, and places of amusement—in which the greater part of our time is spent. As a matter of fact, the only serious attempt at such control occurs during the winter months, when we raise, or endeavor to raise, the interior temperature to the 68 or 70 deg. Fah. which has been found to be the most agreeable to the average person. When we have raised the temperature to the desired degree, we are content to let the equally important question of humidity take care of itself. Consequently, in steam-heated rooms, and particularly in the apartments and flats in which the majority of city dwellers now live, the atmosphere is dried out to an extent which is answerable for an untold amount of discomfort and even disease. Unfortunately, the average individual, if he be warm in winter, is perfectly satisfied; and no doubt it is largely the lack of a demand for means to control the humidity, or ignorance of the necessity for such control, that has prevented the more extended use of the devices which have been provided for this very purpose.

As for the modifying of temperature and humidity in the summer time, the conditions are even worse; and it is really remarkable how little serious attempt there has been to develop suitable systems for the cooling and reduction of the humidity of the interior of buildings during the hot summer weather. This is said with full appreciation of what the inventor and manufacturer have already done in this direction; but attention is drawn to the fact that, in view of the enormous amount of discomfort and distress endured during the hot and humid waves which are continually sweeping over the country, it is surprising that there should not be a more widely-extended effort to bring the heat and humidity in the interior of buildings down to a point at which life would be made comfortable.

Furthermore, the artificial regulation of atmospheric humidity and temperature is a matter of vital concern to certain manufacturing interests, and particularly to the textile industries. In order to secure the best results in spinning mills, it is necessary that both the temperature and humidity be held at a certain relative proportion, and each at a certain degree. Thus, in what is known as the "Bradford spinning," to secure the best results, there should be a low temperature and a low humidity, a fair average for the former being 68 deg. Fah., and for the latter a percentage of 58 to 60. The "French spinning," on the other hand, needs a high temperature of 85 deg. Fah. and a high relative humidity of 85 per cent. Moreover, there are many other lines of business whose success is largely dependent upon the regulation of temperature and humidity, particularly those which deal in confectionery, meat, and provisions, where, if the conditions be not just right, the goods will melt, lose their crispness and freshness, and generally deteriorate in quality.

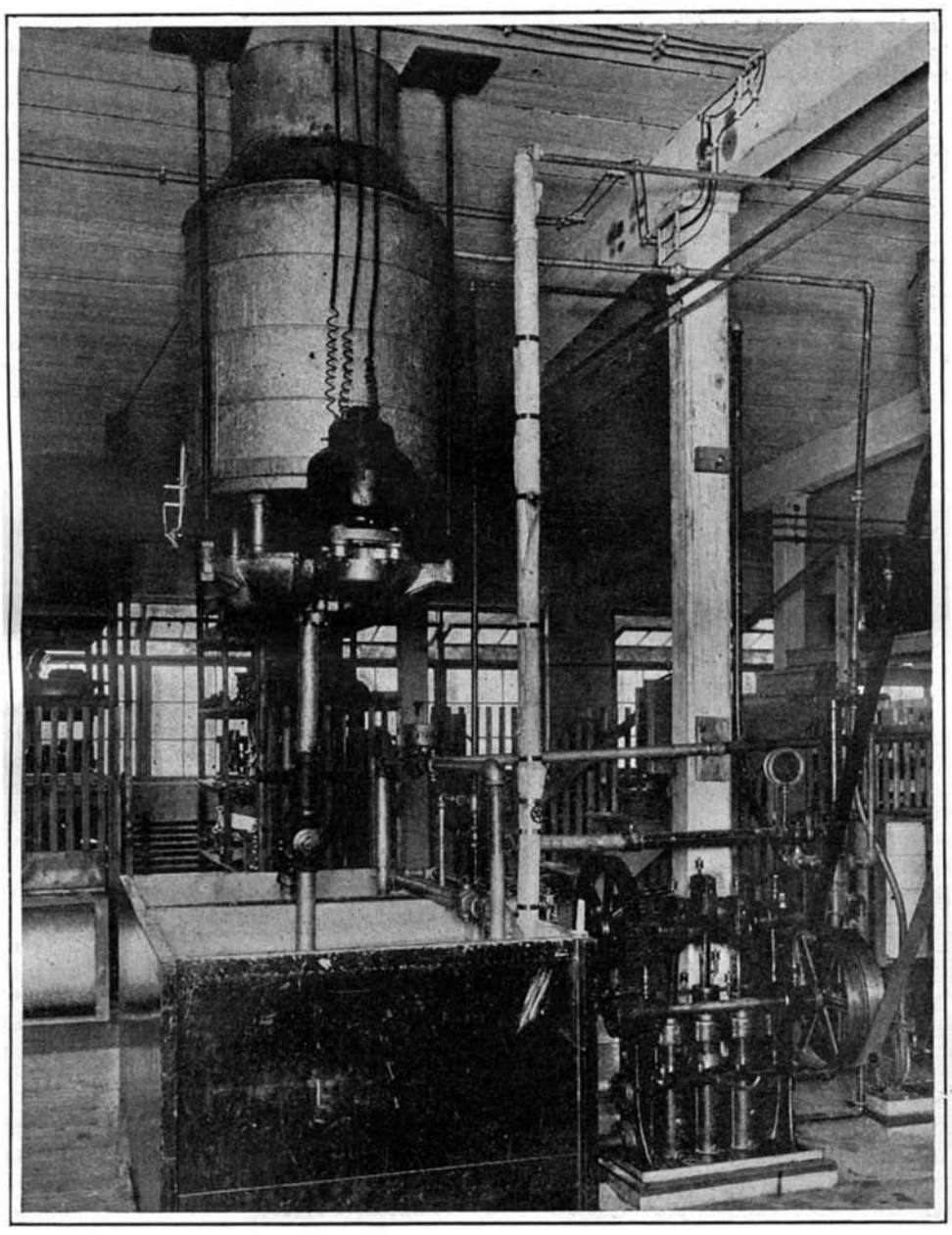
Comfortable weather is that in which there is a desirable relation of humidity to temperature. High temperature alone is not necessarily uncomfortable, nor high humidity alone. There may be days in the fall of the year when, although the relative humidity may be 100 per cent, no discomfort is experienced, for the reason that the temperature is low. On the contrary, in the dry air of the deserts one can endure a temperature of well over 100 deg. without experiencing distressing symptoms. The comfortable weather is that in which the humidity relative to the temperature is in a certain fixed ratio.

The machine which is herewith illustrated has been designed to regulate artificially the ratio between the temperature and the humidity by passing water over a large cooling surface over which, at the same time, large volumes of air are being drawn. By this simple expedient it secures the double effect of cooling the air and imparting to it the moisture of the evaporated water. The "Regenerator," as this machine is called, is made by the Regenerated Cold Air Company, of 88 Broad Street, Boston, Mass. The accompanying illustrations show two sizes of machines. The sectional view is taken through an 18-inch unit, which is capable of handling 1,250 cubic feet of air per minute. The other illustration is of a 24-inch machine, with a capacity of 5,000 cubic feet per minute.

The 18-inch machine consists of an outer casing or covering more or less ornamental in design, which incloses inner cylinders arranged concentrically within it, within which is carried the cooling and humidifying apparatus proper, the whole being mounted upon a hollow base or collecting basin, *M*, which may be carried either upon a pillar set upon the floor, or may be suspended by rods from the ceiling of the room in which the apparatus is used. Mounted centrally is a shaft, *D*, carrying at its upper end an 8-inch impulse wheel, *A*, which is driven by a ¼-inch jet supplied through a pipe, *B*, at a pressure of 85 pounds to the square inch. Immediately below the impulse wheel is another wheel, *C*, which is carried upon a hollow shaft arranged to turn concentrically about the shaft, *D*, moving in the same direction. This movement is effected by the water, which, reacting from the buckets of the impulse wheel, strikes the blades of the lower wheel, causing it to rotate, as described. At the lower end of the hollow shaft on which the wheel, *C*, is mounted, is carried a four-armed distributor, *E*, and the water falling from the wheel, *C*, and flowing down the interior of the casing which incloses the mechanism above described, collects in the hollow hub of the distributor, and is carried thence by centrifugal force out into the four arms, *F*. These are formed with a number of side outlets, which enlarge in cross-sectional area from the center to the circumference, the openings being so adjusted that there shall be an even distribution of the water as it flows out of the arms.

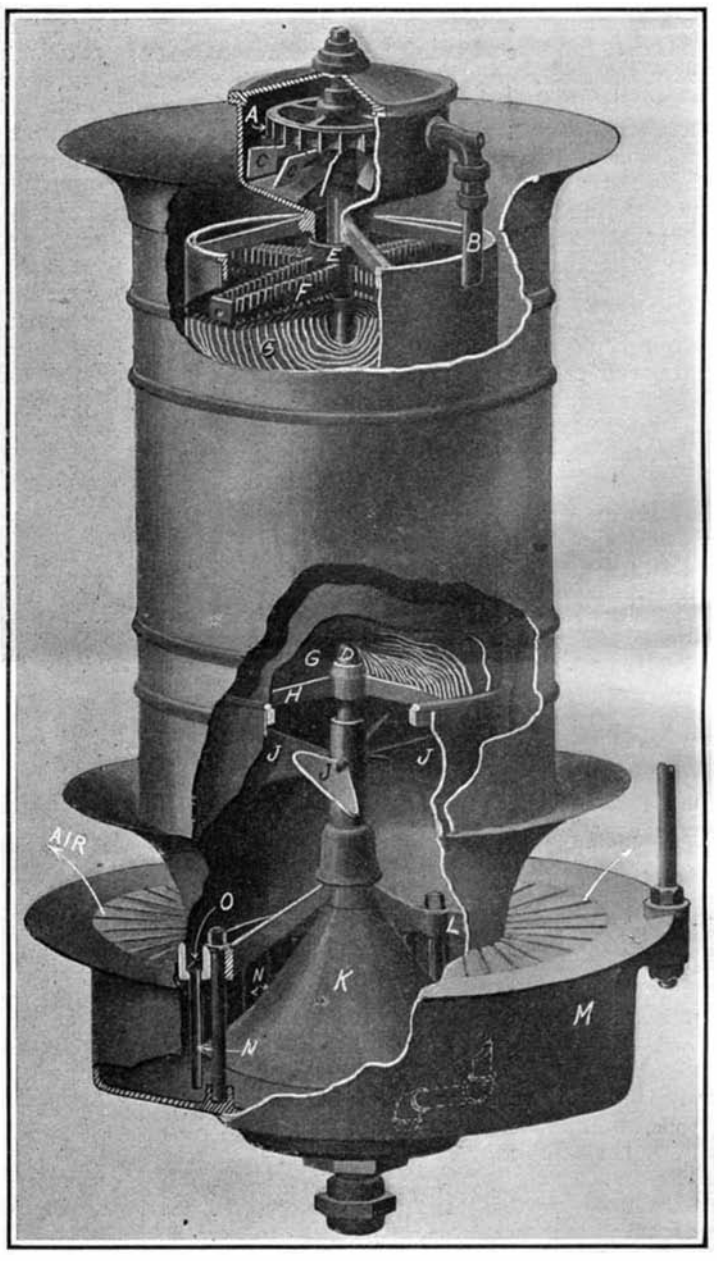
Immediately below the distributor is arranged a set of twenty-four galvanized sheet-iron cylinders, which are placed concentrically, one within the other. The outermost cylinder is 24 inches in diameter, and the whole series is supported upon the four-armed spider, *H*. The water flows down over both sides of each cylinder, the total amount of wetted surface thus afforded being 250 square feet. Immediately below this nest of evaporating cylinders, and mounted at the base of the shaft, *D*, which is driven by the impulse wheel at a speed of 900 revolutions per minute, is a fan, *J*, which serves to create a powerful down draft through the evaporating cylinders.

As the water drains from the base of the cylinders, part of it falls past the fan directly onto a hollow cone, *K*, over which it flows, and finally is caught in the collecting basin, *M*. The water which is caught upon the blades of the fan, representing about 50 per cent of the whole, is thrown against the walls of the incasing cylinder and drains down into an annular trough, *O*, formed in the periphery of a three-armed casting, *L*, which serves to support the bottom bear-



This View Shows the Regenerator, Hung from the Ceiling; the Motor for Driving the Fan; the Feed and Return Tanks; the Pump and Connections.

A 24-INCH AIR REGENERATOR; CAPACITY, 5,000 CUBIC FEET PER MINUTE.



This Machine Has a Capacity of 1,250 Cubic Feet Per Minute.

SECTIONAL VIEW THROUGH AN 18-INCH AIR REGENERATOR.

ing of the center shaft, *D*. From the annular trough the water flows through a number of vertical pipes, *N*, into the collecting basin, *M*, from which it is conducted by an outflow pipe.

The great capacity of this machine, both for cooling and humidifying, is due to the large amount of evaporating surface provided in the nest of cylinders, combined with the large volume of air which is drawn through the cylinders by the fan. The air, with its temperature raised or lowered and its humidity increased or decreased, passes out into the room through the annular opening between the cylinder and the collecting basin, as indicated by the arrow.

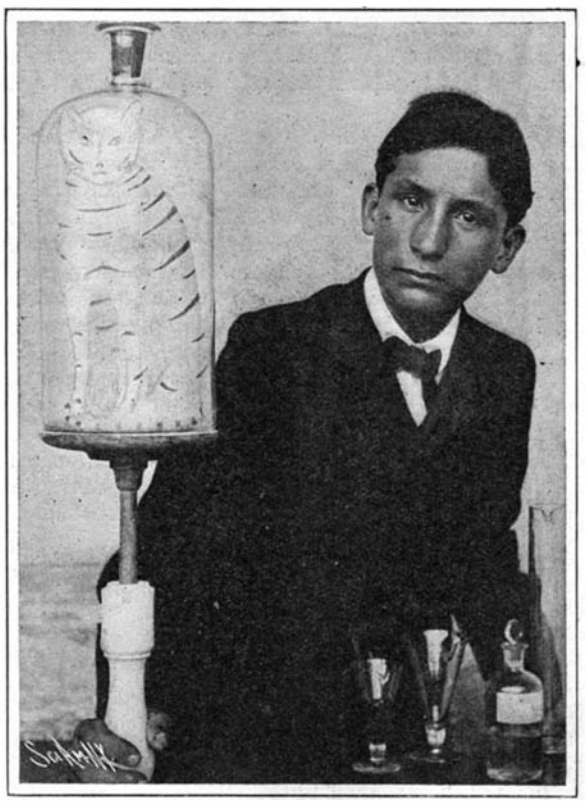
The accompanying table gives the results of an hour and fifteen minutes' test conducted for a representative of this paper, with the 24-inch machine, which forms the subject of one of the engravings. The test was conducted in a machine shop containing 105,000 cubic feet of air. The generator is suspended from the roof by rods, which pass through the base. The fan is driven by a motor which will be seen mounted upon the base, from the bottom of which will be seen the water discharge pipe, which leads down to connect with one or other of two adjoining water tanks. Connecting with each of the tanks is a series of feed pipes, provided with the necessary valves, etc., and leading to a three-throw circulating pump, which will be seen adjoining the tanks. The connections are so arranged that the water may be drawn from one tank, forced over the cooling surfaces of the machine, and discharged into the other tank, or *vice versa*. There are also steam pipe connections, by which the water in the tanks may be raised to the desired degree of temperature.

TEST OF 24-INCH AIR REGENERATOR.

Time.	Thermometer in Room.		Relative Humidity	Water.		Air Delivered by Machine.		
	Dry.	Wet.		Feed.	Return.	Dry.	Wet.	Relative Humidity
	Deg.	Deg.	Per Cent.	Deg.	Deg.	Deg.	Deg.	Per Cent.
12.25	78	67	57	105	93	87	82	80
12.40	79	72	72	110	96	87	82	80
1.10	81	75	75	110	96	88	85	88
1.10	81	75	75	67	96	88	85	88
1.25	81	74	72	71	72	77	72	78
1.40	81	73	68	71	72	76	70	74

Although the air regenerator is designed primarily for cooling the air and reducing humidity, its range of application is much wider than its name would indicate. It is capable not only of decreasing the humidity and lowering the temperature in a room, but, if desired, as in the case of a room in a textile factory, it can increase the humidity and raise the temperature. Furthermore, it can be used to increase or decrease the humidity while maintaining the temperature the same. The method of securing these results is as follows: When it is predetermined to increase the humidity and raise the temperature, the water in the feed tank is heated by steam to a certain desired temperature. This hot water is fed to the machine and distributed over the evaporating surface, where its heat and vapor are imparted to the air, as the latter is drawn through. Conversely, when it is desired to decrease the humidity of a room and lower the temperature, the flow of water is reversed, the cold tank being used as the feed and the hot tank as the return. The resultant effect upon the air is that its moisture is condensed on the cold water which is flowing over the plates, and its temperature lowered.

At the beginning of the test of one hour and fifteeen minutes, above referred to, the dry-bulb thermometer, placed about 50 feet distant from the machine, showed a temperature inside the room of 78 deg.; the relative humidity was 57 per cent; and the outside temperature was 81 deg. As the first half of the test was designed to increase the humidity, the feed water had been raised by means of a steam jet to 105 deg. The air was taken in from the outside of the building at a temperature of 81 deg., and drawn over the evaporating surfaces. The test started at 12:25, and forty-five minutes later the dry thermometer inside the room showed 81 deg., and the relative humidity had risen to 75 per cent. At 1:10 the operation of the machine was reversed, and the process of cooling and reduction of humidity commenced, the



A CHEMICAL TRICK.

feed water being passed into the machine at 67 deg., and the feed of air being drawn from the interior of the building. Half an hour later, the temperature inside was 81 deg., the relative humidity had fallen to 68 deg., the outside temperature at the time being 82 deg., and the relative humidity of the outside air being 74 per cent.

It should be mentioned in conclusion that inlet air ducts are provided in each regenerator, by which the air may be fed either directly from the atmosphere or taken from the upper strata of air in the room itself. The manipulation of these air dampers, the control of the temperature of the feed water, and the further control of the speed of the fan, render it possible to secure a very delicate regulation of the interior atmosphere of any room in which they are installed. Furthermore, the introduction of large volumes of pure air from the outside, its passage over running water where the dust is caught and removed, and its thorough circulation through the room or building, is in itself a potent safeguard to the health of the inmates.

The American Society of Civil Engineers has admitted a woman to membership in one of its lower grades.

A CHEMICAL TRICK.

BY GUSTAVE MICHAUD, D.SC.

When we happen to witness a phenomenon which seems to violate natural laws, we are not likely to forget its cause if it be explained to us. The following experiment, which I devised for my students, helped them to understand as well as to remember some chemical data.

A white cat, made of flexible pasteboard and imprisoned in a glass jar, is shown to the audience. The lecturer announces that, without opening the jar or even touching it, he will cause the cat to undergo a zoological as well as a chemical transformation. He takes the support of the jar, and pushes it forward in full view of the students. The change occurs almost instantaneously. The cat takes a rich orange color on which black transversal stripes rapidly paint themselves. The cat has become a tiger.

The whole transformation is produced by emanations of hydrogen sulphide, which is generated in the jar itself without any visible apparatus. The cat has been previously coated with a solution of chloride of antimony wherever the orange hue was to be produced, and with a solution of basic acetate of lead wherever the black stripes were to appear. Both solutions are colorless. After the coated cat has been introduced in his glass cage, a small piece of pasteboard is placed under the wooden support so as slightly to incline the jar forward. A few decigrammes of pulverized sulphide of iron folded in a piece of blotting paper are deposited behind the cat, on the elevated side of the bottom of the jar. Two or three cubic centimeters of diluted sulphuric acid are dropped with a pipette on the opposite side. When the performer wishes the transformation to take place, he takes the wooden support and pushes it forward as if he wanted to enable everybody to see better what is going to happen. By so doing he suppresses the slight inclination which kept the iron sulphide beyond the reach of the sulphuric acid. The gas is evolved, and the formation of the orange sulphide of antimony and black sulphide of lead takes place in a few seconds.

THE ART OF INVENTING.

BY EDWIN J. PRINDLE, OF THE NEW YORK BAR.

It seems to be popularly believed that the inventor must be born to his work, and that such people are born only occasionally. This is true, to a certain extent, but I am convinced there are many people who, without suspecting it, have latent inventive abilities, which could be put to work if they only knew how to go about it. The large percentage of inventors in this country compared with all other countries, shows that the inventive faculty is one which can be cultivated to some extent. The difference in ingenuity is not wholly a matter of race, for substantially the same blood exists in some other countries, but it is the encouragement of our patent laws that has stimulated the cultivation of this faculty.

The popular idea seems to be that an invention is produced by its inventor at a single effort of the imagination. It is, undoubtedly, true that every inventor must have some imagination or creative faculty, but, as I shall seek to show, this faculty may be greatly assisted by method. While reasoning does not constitute the whole of an inventive act, it can, so to speak, clear the way and render the inventive act easier of accomplishment.

In the making of all inventions which do not consist in the discovery of the adaptability of some means to an end not intentionally being sought after, the first step is the selection of a problem. The inventor should first make certain that the problem is based upon a real need. Much time and money is sometimes spent in an effort to invent something that is not really needed. What already exists is good enough or is so good that no additional cost or complication would justify anything better. The new invention might be objec-

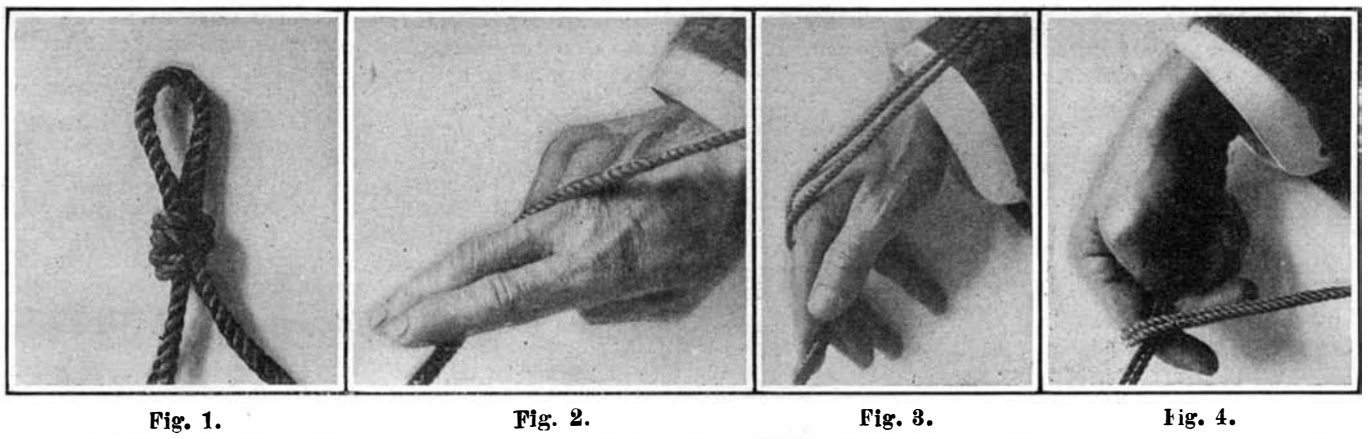


Fig. 1. Fig. 2. Fig. 3. Fig. 4.

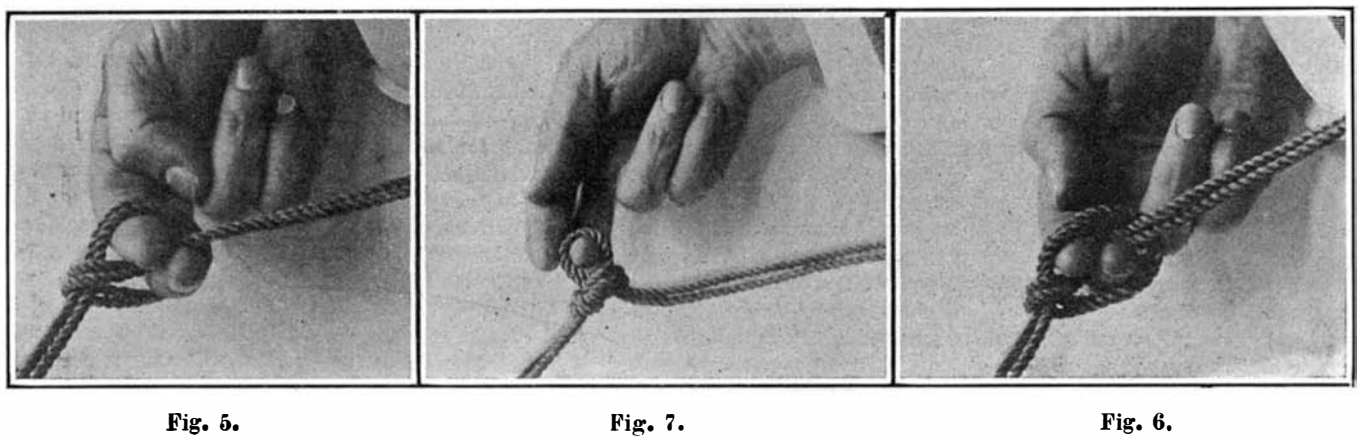


Fig. 5. Fig. 7. Fig. 6.

HOW THE CORD KNOTTER OF THE SELF-BINDING HARVESTER WAS INVENTED.

tionable because it would involve counter disadvantages more important than its own advantages, so that a really desirable object is the first thing to be sure of.

Having selected a problem, the next step should be a thorough analysis of the old situation, getting at the reasons for the faults which exist, and in fact discovering the presence of faults which are not obvious to others, because of the tendency to believe that whatever is, is right.

Then the qualities of the material, and the laws of action under which one must operate should be exhaustively considered. It should be considered whether these laws are really or only apparently inflexible. It should be carefully considered whether further improvement is possible in the same direction, and such consideration will often suggest the direction in which further improvement must go, if a change of direction is necessary. Sometimes the only possible improvement is in an opposite direction. A glance at the accounts of how James Watt invented the condensing steam-engine will show what a large part profound study of the old engine and of the laws of steam played in his invention, and how strongly they suggested the directions of the solutions of his difficulties.

We now come to the constructive part of inventing, in order to illustrate which, I will seek to explain how several inventions were, or could have been, produced.

The way in which the first automatic steam engine was produced was undoubtedly this—and it shows how comparatively easily a really great invention may sometimes be made. It was the duty of Humphrey Potter, a boy, to turn a stop-cock to let the steam into the cylinder and one to let in water to condense it at certain periods of each stroke of the engine, and if this were not done at the right time, the engine would stop. He noticed that these movements of the stop-cock handles took place in unison with the movements of certain portions of the beam of the engine. He simply connected the valve handles with the proper portions of the beam by strings, and the engine became automatic—a most eventful result.

A most interesting example of the evolution of an invention is that of the cord-knotter of the self-binding harvester. The problem here was to devise a mechanism which would take the place of the human hands in tying a knot in a cord whose ends had mechanically been brought together around a bundle of grain.

The first step was to select the knot which could be tied by the simplest motions. The knot which the inventor selected is that shown in Fig. 1, and is a form of bow-knot.

The problem was to find how this knot could be tied with the smallest number of fingers, making the smallest number of simple movements. As anyone would ordinarily tie even this simple knot, the movements would be so numerous and complex as to seem impossible of performance by mechanism. The inventor, by study of his problem, found that this knot could be tied by the use of only two fingers of one hand, and by very simple movements. The knot will best be understood by following the motions of these fingers in tying the knot. Using the first and second fingers of the right hand, they are first swept outward and backward in a circular path against the two strands of the cord to be tied, as shown in Fig. 2.

The fingers continue in their circular motion backward, so that the strands of the cord are wrapped around these fingers, as shown in Fig. 3.

Continuing their circular motion, the fingers approach the strands of the cord between the twisted portion and a part of the machine which holds the ends of the cord, and the fingers spread apart as shown in Fig. 4, so that they can pass over and grasp the strands thus approached, as shown in Fig. 5. The fingers then draw back through the loop which has been formed about them, the fingers holding the grasped portion of the strands, as shown in Fig. 6.

The knot is finished by the completion of the retracting movement of the fingers through the loop, thus forming the bow of the knot as shown in Fig. 7.

The inventor found that one finger could have a purely rotary movement, as if it were fixed on the arm and unable to move independently of the arm, and the movement being as if the arm rotated like a shaft, but the second finger must be further capable of moving toward and from the first finger to perform the opening movement of Fig. 4, and the closing movement of Fig. 5, by which it grasps the cord. The inventor accordingly, from his exhaustive analysis of his problem, and his invention or discovery of the proper finger motions, had further only to devise the very simple mechanical device illustrated in Fig. 8 to replace his fingers.

The index finger of the hand is represented by the finger *S*, which is integral with the shaft *V*. The second finger of the hand is represented by the finger, *U*, which is pivoted to the first finger by the pin, *s*. The grasping movement of the finger, *U*, is accomplished by a spring, *V'*, bearing on the shank, *U'*, and its opening movement is caused by the travel of an anti-friction roll, *U''*, on the rear end of the pivoted finger, over a cam, *V''*, on the bearing of the shaft. The shaft is rotated by the turning of a bevel pinion, *W*, on the shaft through the action of an intermittent gear. The necessity of drawing the fingers backward to accomplish the movement between Figs. 5 and 7 was avoided by causing the tied bundle to have a motion away from the fingers as it is expelled from the machine, the relative motion between the fingers and the knot being the same as if the fingers drew back.

Thus the accomplishment of a seemingly almost impossible function was rendered mechanically simple by an evolution from the human hand, after an exhaustive and ingenious analysis of the conditions involved.

It will be seen from the example I have given that the constructive part of inventing consists of evolution, and it is the association of previously known elements in new relations (using the term elements in its broadest sense). The results of such new association may, themselves, be treated as elements of the next stage of development, but in the last analysis nothing is invented or created absolutely out of nothing.

It must also be apparent, that pure reason and method, while not taking the place of the inventive faculty, can clear the way for the exercise of that faculty and very greatly reduce the demands upon it.

Where it is desired to make a broadly new invention on fundamentally different lines from those before—

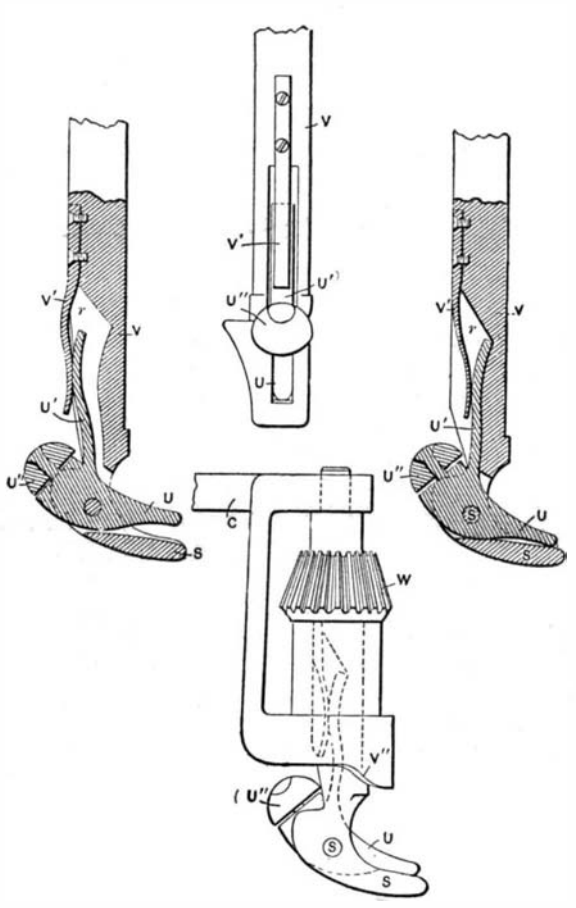


Fig. 8.

THE MECHANICAL FINGERS OF THE CORD KNOTTER.

having first studied the art to find the results needed, the qualities of the material or other absolutely controlling conditions should be exhaustively considered; but at the time of making the inventive effort, the details should be dismissed from the mind of how results already obtained in the art were gotten. One should endeavor to conceive how he would accomplish the desired result if he were attempting the problem before any one else had ever solved it. In other words, he should endeavor to provide himself with the idea elements on which the imagination will operate, but to dismiss from his mind as much as possible the old ways in which these elements have been associated, and thus leave his imagination free to associate them in original and, as to be hoped, better relations than before. He should invent all the means he can possibly invent to accomplish the desired result, and should then, before experimenting, go to the art to see whether or not these means have before been invented. He would probably find that some of the elements, at least, have been better worked out than he has worked them out. Of course, mechanical dictionaries, and other sources of mechanical elements and movements will be found useful in arriving at means for accomplishing certain of the motions, if the invention be a machine. Many important inventions have been made by persons whose occupation is wholly disconnected with the art in which they are inventing, because their minds were not prejudiced by what had already been done. While such an effort is likely to possess more originality than that on the part of a person in the art, there is, of course, less probability of its being thoroughly practical. The mind well stored with the old ways of solving the problem will be less likely to repeat any of the mistakes of the earlier inventors, but it will also not be as apt to strike out on distinctly original lines. It is so full, already, of the old forms of association of the elements as to be less likely to think of associating them in broadly new relations.

Nothing should be considered impossible until it has been conclusively worked out or tried by experiments which leave no room for doubt. It is no sufficient reason for believing a thing won't work because immemorial tradition, or those skilled in the art, say it will not work.

In inventing a machine to operate upon any given material, the logical way is to work from the tool to the power. The tool or tools should first be invented, and the motions determined which are to be given to them. The proper gearing or parts to produce from the power each motion for each tool should then be invented. It should then be considered if parts of each train of gearing cannot be combined, so as to make one part do the work of a part in each train; in short, to reduce the machine to its lowest terms. Occasionally a mechanism will be invented which is exceedingly ingenious, but which it is afterward seen how to simplify, greatly at the expense of its apparent ingenuity. This simplification will be at the sacrifice of the pride of the inventor, but such considerations as cheapness, durability, and certainty of action leave no choice in the matter. It will sometimes be found that a single part can be made to actuate several parts, by the interposition of elements which reverse the motion taken from such part, or which take only a component of the motion of such part, or the resultant of the motion of such part and some other part. Where a machine involves the conjoint action of several forces, it can be more thoroughly studied, if it is found there are positions of the machine in which one force or motion only is in operation, the effect of the others in such position being eliminated, and thus the elements making up the resultant effect can be intelligently controlled.

The drawing board can be made a great source of economy in producing inventions. If the three principal views of all the essentially different positions of the parts of a machine are drawn, it will often be found that defects will be brought to light which would not otherwise have been observed until the machine was put into the metal.

It is desirable to see the whole invention clearly in the mind before beginning to draw, but if that cannot be done, it is often of great assistance to draw what can be seen, and the clearer perception given by the study of the parts already drawn, assists the mind in the conception of the remaining parts.—Abstract of a paper read before the American Institute of Electrical Engineers.

Start of the Wellman Polar Airship Expedition from Paris.

On Friday, the 15th instant, Walter Wellman, the intrepid explorer who is about to attempt the 1,200-mile journey from Tromsoe, Norway, to the North Pole and back in the largest dirigible balloon that has ever been built, started from Paris. A special freight train was employed to transport the airship, its appurtenances, and supplies to Norway. Mr. Wellman will be accompanied on his journey of exploration by an appointee of the United States Weather Bureau, an expert aeronaut, and a mechanic. Notwithstanding that a recent test of the two motors of the airship is said to have shown the development of 100 horse-power as against the 75 contracted for, Wellman expressed himself as much better satisfied with the balloon part of his airship than with its mechanical features. He expects to get the latter perfected, however, and to make a number of trial tests before starting on the actual journey about the first of August. In case of an accident to the airship, the explorers expect to make their way back over the ice on sledges drawn by the motor ski-supported bicycle illustrated in our last issue.

The principal producing centers of coke in Germany are on the Ruhr, on the Sorre, at Aix-la-Chapelle, in Silesia, in the environs of Obernkirchen, and near Zwickau in Saxony. The basin of the Ruhr produces, according to the German statistics, about 65,000,000 tons of coal and about 11,000,000 tons of coke annually. This is the firmest of the German cokes and the most valuable with reference to its chemical constitution. The following figures are compiled from late sources and show that Germany is at the head of the European countries in this branch of industry, and is second only to the United States:

Germany, 14,004 tons; Great Britain, 10,000; Belgium, 2,048; Russia, 2,000; France, 1,850; Austria-Hungary, 1,300; Spain, 405; Sweden, 60; Denmark, 19; Italy, 18. Total for Europe, 31,704 tons.

United States, 23,039 (this figure is not the latest return, but will answer for comparison); Canada, 342; Japan, 70; Australia, 127; add Europe, 31,704. Total for the entire world, 55,282 tons.—Revue des Eclairages.

A ONE-HUNDRED-TON DERRICK CRANE FOR FITTING OUT VESSELS.

BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

An interesting electric crane of the derrick type is now in operation at the Greenock dockyards of the Scott Shipbuilding and Engineering Company, on the River Clyde, for facilitating and expediting fitting-out operations on large vessels. The crane has been designed and constructed by Messrs. George Russell & Co., of Motherwell near Glasgow, to whose courtesy we are indebted for the accompanying illustration. The crane is erected on the west bank of a new fitting-out basin that has recently been completed. Owing to the design of the crane, it has been possible to place its center extremely close to the edge of the quay wall.

As will be observed from the illustration, the crane itself is carried on three masonry pedestals or piers, the advantage accruing from which is that it is possible to get clearance for the sides of vessels. The piers supporting the center mast and diagonal legs are continued to a height of twenty-five feet above the level of the quay. The piers are built upon concrete foundations of a great depth. In the case of the pedestal carrying the vertical mast of the crane, the center of the pier is only seven feet from the edge of the quay. This enables the crane to deal with its maximum load of one hundred tons at an effective reach of sixty-three feet from the edge of the quay.

The mast of the crane is built up of steel plates and angles well braced together, and connected at the bottom by a massive steel box girder, which transmits the vertical pressure to the center pin. This vertical pressure is distributed over the surface of the concrete by a large base, which insures the imposition of a small pressure on each square foot of concrete. At the top of the mast is a heavy forged steel post, in which the upper end of the mast terminates, and to which also the diagonal legs are fixed by means of trunnion rings. To overcome the liability of bending stresses upon the diagonal stays, the connecting arrangement at this upper end is such that the center line of each diagonal intersects the center line of the mast. To the concrete base is bolted a heavy steel plate, which carries the cast-steel slewing rim of the crane, and also a cast-steel socket in which the center pin is fitted.

The tapered diagonal legs are connected at their bases with the central pier by horizontal stays built of steel plate and angles. In order to resist any compressive strains to which they might be subjected, they are stiffened by a lattice construction. The diagonal legs rise at an angle of forty-five degrees, while the base horizontal girders similarly form an angle of forty-five degrees with the edge of the wharf in the ground plan, thereby leaving ample space on either side of the crane for the accommodation of material. The railroad tracks are laid parallel with the edge of the wharf.

The electrical equipment comprises four motors and gearing. For derricking the jib, there is one motor of fifty horse-power running at 290 revolutions per minute; one of similar horse-power for the main purchase hoisting, and two of thirty-five brake horse-power for light purchase hoisting and slewing respectively, representing an aggregate of 170 brake horse-power. Each motor and its attendant gearing are independent, and all are controlled from a cabin carried on the side of the mast at a height of fifty-six feet above the level of the quay, so that the operator has a clear and uninterrupted view of the whole field of operations. The equipment in the cabin comprises the main switchboard and four controllers, as well as the hand wheels for applying the auxiliary braking arrangements. Each motion is fitted with automatic electric brakes, and for the hoisting and derricking gears powerful hand brakes are provided. All the main spur wheels are of cast steel, while the smaller wheels and pinions have machine-cut teeth. In the cases of the slewing and derricking gearing the worm-wheels are of gun metal, with the worms of forged steel. The main barrels for hoisting and derricking are of seven foot diameter, right and left screw grooved in the lathe. The design of these barrels constitutes an important feature, since the spur gears are placed in the center of the barrels, with the two sections of the barrel on either side grooved right and left hand, so that the ropes can coil on both ends simultaneously, thereby dividing the stresses equally between the two sides of the mast. Four hundred feet of cable can be wound on each section.

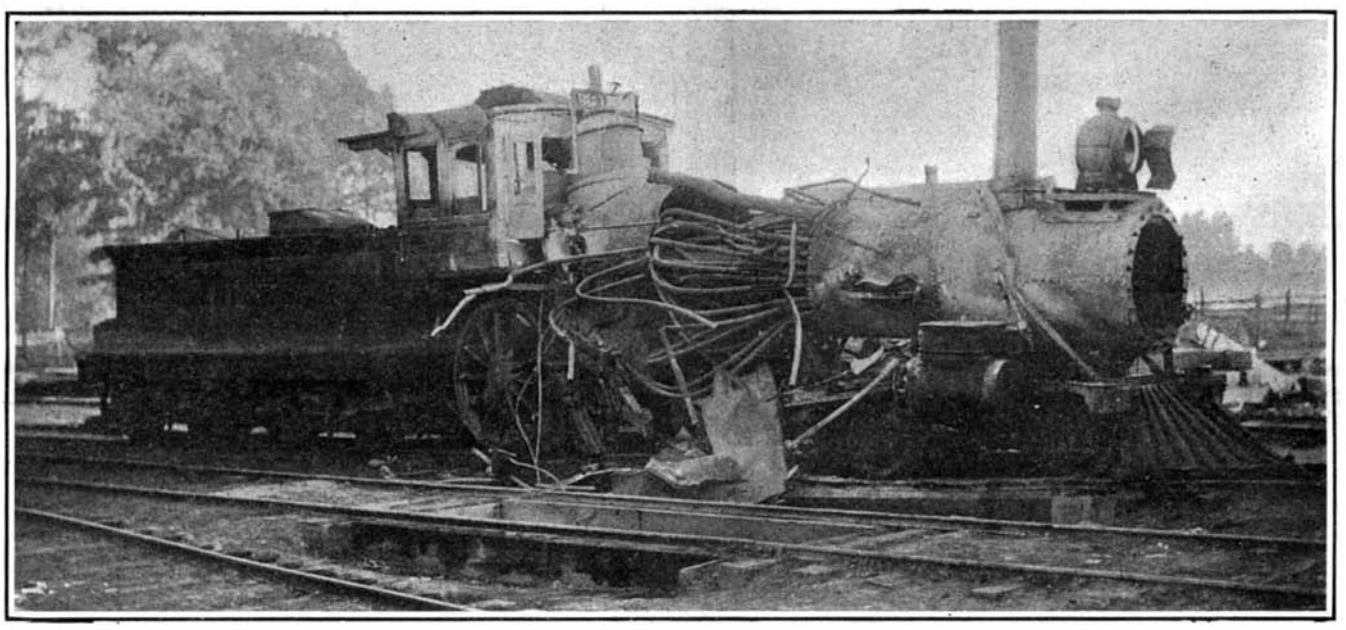
In order to clear the gunwales of a vessel when the crane is working at its maximum radius of seventy feet, there is allowed a clear height of thirty-five feet between the edge of the wharf and the under side of the jib. The main hoisting block has a vertical range of one hundred feet, and the load is carried on eight parts of rope, thereby giving a duplicate quadruple purchase. The load-carrying device is ingenious. There is a cylinder containing oil on which the load is carried, and the latter is able to revolve with very little resistance by means of a lifting ring with a piston at its upper end. In order to overcome oil leaking from the cylinder, which is made of steel, there is a gun-metal liner three-eighths inch in thickness.

The crane has been tested to one hundred and twenty tons with complete success, though the maximum working load is one hundred tons at any radius between a maximum of seventy feet and twenty-five feet, at a lifting speed of five feet per minute. Ninety tons can be raised at seventy-five-foot, eighty tons at eighty-foot, seventy tons at eighty-five-foot, and sixty tons at ninety-foot radii. With loads from ten to fifty tons the lifting speed is ten feet per minute, and for loads less than ten tons, forty feet per minute. With the independent light purchase gear a weight of ten tons can be lifted at any radius up to one hundred feet. The slewing speed with the full load of one hundred tons is one hundred feet per minute.

With this appliance the operations of fitting out a vessel can be expeditiously carried out. The radius of the crane enables the whole beam of the ship to be commanded; and for lifting and lowering into position the heavier sections of the vessel's machinery installations, it has proved to be especially advantageous.

A LOCOMOTIVE BOILER EXPLOSION.

It is seldom surely that the ubiquitous camera has recorded a more picturesque view of an exploded locomotive boiler than that shown in the accompanying illustration. The accident happened at the town of Daleville, Ark., on a road known as the Ultima Thule, Arkadelphia and Mississippi Railroad. The engine had been in the shop undergoing repairs, which had just been completed. After washing out the boiler, sufficient steam was raised to run the engine out of the shop and over the cinder pit, where the explosion occurred. The injectors on both sides had just been tested and found in good condition, and by the use of the blower the steam had been raised to the desired pressure of about 145 pounds to the square inch, when the boiler gave way. We are indebted for the photograph to Mr. A. A. Peters, master mechanic of the A. S. W. R. R., of Gurdon, Ark., who informs us that it was impossible to determine the age of the boiler, the name and number plate both having been removed. It was built of ⅜-inch iron, and the seam on the bottom of the barrel was reinforced with an additional ⅜-inch sheet, making with the covering strip a total thickness of 1⅛ inches. The explosion tore the sheet off through the line of the rivet holes, tearing into the connection sheet near the firebox. The barrel was entirely carried away between the firebox and the front rings of the boiler. Twenty of the flues collapsed, and were split open as though they had been cut through with a chisel, for a length of from 10 to 24 inches. The front flue sheet was broken in pieces and the nozzle and front end were blown entirely away. At the time of the accident a man was oiling the driving box of the front right-hand driver. The explosion tore the frame apart at this point, blew this driving wheel off its axle and entirely away from the engine, and, of course, killed the oiler. Subsequently to the accident, Mr. Peters, who was called in to investigate, and, if possible, explain the explosion, took off the pop valve, tested it with water pressure, and found that it went off at 140 pounds. The engine had been carrying 145 to 150 pounds previous to its visit to the shops. One fact to be noted was that some time previously a new firebox had been put in the boiler, and there was a smaller number of flue holes in the firebox flue sheet than in the front flue sheet. These surplus holes were closed with pocket-flues, nearly all of which blew out of the sheet at the time of the explosion, and crashed into different places in the machine shop. Some idea of the enormous energy of the explosion is given by the fact that these pocket flues had been rolled into the flue sheet and beaded.



Forward Driving Wheel Blown Away; Bar Frame Broken; and One Section of Barrel Entirely Destroyed.

DISRUPTIVE FORCE OF A LOCOMOTIVE BOILER EXPLOSION.

As to the cause of the disaster, we can only suggest that in putting on the reinforcing strip along the bottom seam of the barrel, fresh rivet holes may have been drilled intermediate of those already there, and the available sectional area along the seam so greatly reduced, that it was actually weaker rather than stronger for the third plate. The fact that the sheet parted, in spite of its total thickness of 1⅛ inches, along the line of the rivet holes, would seem to suggest this as the cause of the disaster.

The Current Supplement.

The current SUPPLEMENT, No. 1590, is opened with an illustrated article on the rotary converter sub-stations of the Long Island Railroad. A very practical article is that on Tinning. Mr. J. E. Thornycroft concludes his articles on gas-engines for ship propulsion. The second installment on "Canals, Ancient and Modern," is published. Mr. Nelson P. Hulst concludes his treatise on the Metals in Human Progress. Some statistics are published on the foreign commerce of the United States. Mr. Robert Grimshaw writes instructively on Gypsum, a much-misunderstood material. Some devices for determining the energy losses in sheets of iron are described by Dr. Alfred Gradenwitz. Perhaps the most important paper in the current SUPPLEMENT is that by Marconi on the control of the direction of electric waves. The paper relates to results observed when, for the usual vertical antenna employed as receiver or absorber in a wireless telegraph station, there is substituted a straight, horizontal conductor placed at a comparatively small distance above the surface of the ground or water. Major Ormond M. Lissak's paper on Primers and Fuzes for Cannon is concluded. The preliminary report of the State Earthquake Investigation Commission is presented.

Since 1898 there have been completed for the French navy thirteen armored cruisers, which may be divided into five types: Three units of 7,700 tons, three of 9,500 tons, five of 10,000 tons, one of 11,300 tons, and one of 12,500 tons. In addition to these, there are under construction three additional cruisers of 12,500 tons, and three of 13,600 tons.

The Armament of the "Dreadnought.

As a result of prolonged trials and experiments by the British Admiralty, it has been decided that the main armament of the "Dreadnought," which is rapidly approaching completion, is to comprise ten of the new 12-inch Mark X wire-wound, breech-loading, quick-firing guns. The weapon is the most powerful that has yet been designed for naval purposes. It is 45 calibers and weighs 58 tons. The weight of the projectile is still, however, the same as in the former weapon, that is, 850 pounds, but its penetration is much greater, being through 51 inches of wrought iron at the muzzle, while its velocity is 2,900 foot-seconds. The powder charge will be 325 pounds of modified cordite. The firing capacity of this weapon is two rounds per minute. The "Dreadnought" will be ready for steam and gunnery trials in October, by which time construction will have occupied a little more than one year.

FRENCH CANDLE MAKING.

BY JACQUES BOYER.

The tallows, oils and other fatty substances from which common candles are made are mixtures of a solid fat, stearine, with a liquid fat, or oil, oleine. Most of the defects of the old-fashioned tallow candle are due to the latter ingredient, the elimination of which results in the production of a stearine candle, which does not run and "gutter" in burning or grease everything that it touches. The problem of producing stearine candles, first broached by Braconnot, was solved theoretically by the celebrated Chevreul and practically by Milly and Dr. Motard, who succeeded in overcoming the technical difficulties and laying the foundation of the new industry. In particular, they substituted lime for soda in the process of saponification and employed boric acid in the preparation of the wicks, a treatment which is essential to satisfactory combustion. Since their time the various operations of the manufacture have been little changed except by the introduction of some mechanical improvements.

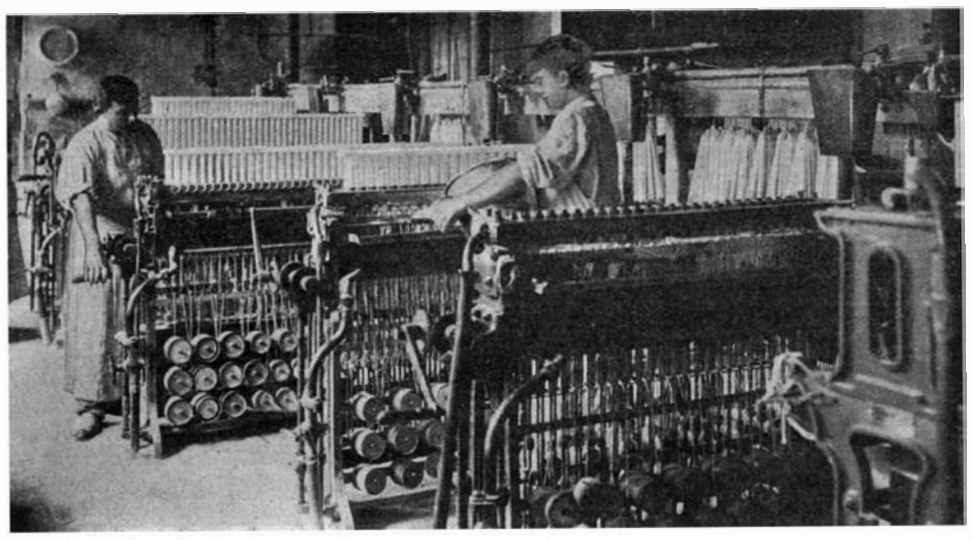


Fig. 1.—Molding Stearine Candles.

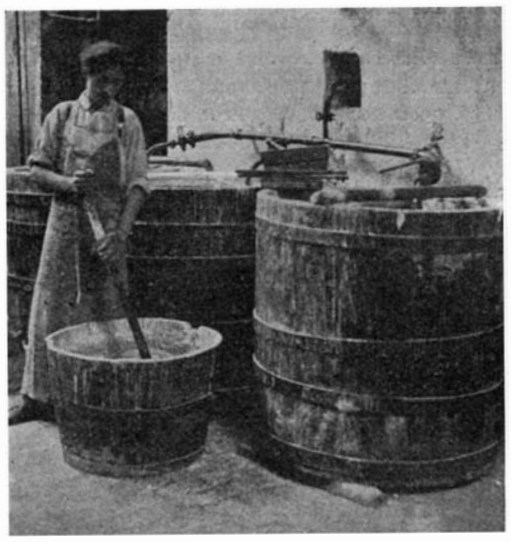


Fig. 2.—Mixing Colors with Stearine.

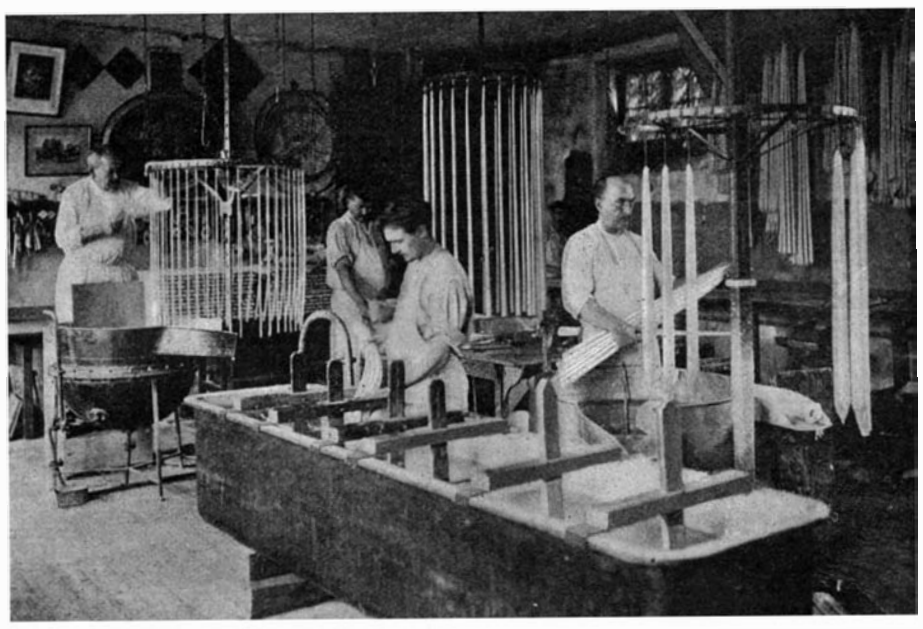


Fig. 3.—The Wax Candle Room.

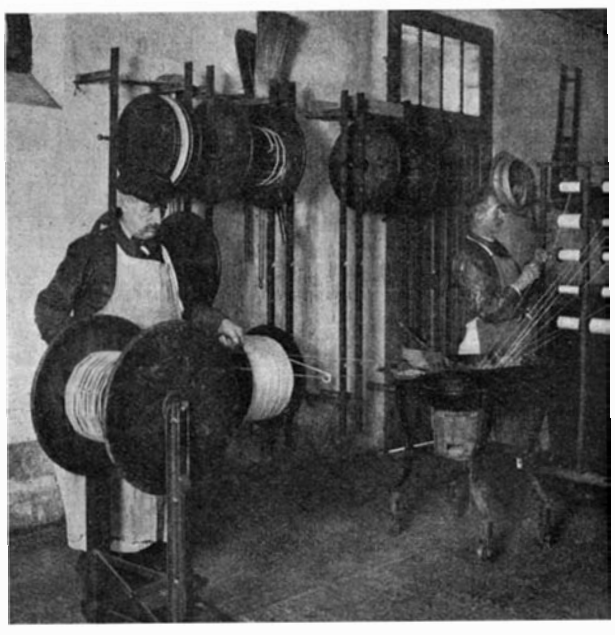


Fig. 4.—Making "Cellar Rats" or Long Wax Tapers.

Fig. 5.—Rolling Wax Candles.

Fig. 7.—Cupping, Labeling and Packing Night Lights.

The first process is the saponification of the fats, which is effected in closed vessels, under pressure, a condition which reduces the proportion of lime required for precipitation to two or three per cent. A cylindrical copper boiler is filled with about 4,000 kilogrammes (4 tons) of tallow or oil and 2,000 liters (550 gallons) of water in which 120 kilogrammes (264 pounds) of lime have been slaked. Steam at a pressure of eight atmospheres is then introduced and the digestion is continued for four hours. When the contents of the vessel have cooled to 130 deg. C. (266 deg. F.) they are drawn off in two successive portions, one consisting of the fatty acids resulting from the action of the steam on the fats, and the other of glycerine and water, holding in suspension the lime soap which, when decomposed by sulphuric acid, yields an additional quantity of fatty acids. The mixture of fatty acids, when freed from glycerine, consists of solid stearic and palmitic acids and liquid oleic acid. (The "stearine" of commerce is a mixture of stearic and palmitic acids.) The mixture of the three fatty acids is treated with sulphuric acid, washed with steam, distilled and run into iron pans where it solidifies in thin cakes. These cakes, wrapped in haircloth, are first pressed cold and then pressed again between cast-iron plates heated by steam to 35 or 40 deg. C. (95 to 104 deg. F.). In these operations the oleic acid is forced out through the filtering cloth leaving the "stearine" behind as a white, solid, and brittle mass.

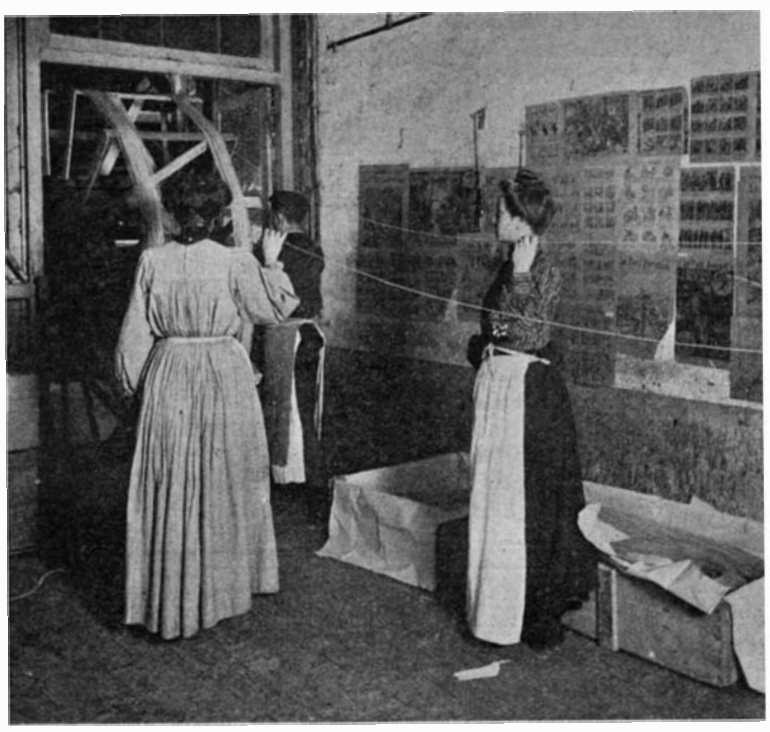


Fig. 8.—Reeling Wax Tapers.

THE MANUFACTURE OF CANDLES IN FRANCE.

The wick of the stearine candle is composed of three cotton strands braided together. One of the strands is twisted more tightly than the others, the result being that the end of the wick, as it burns, bends to one side and reaches the outer or oxidizing part of the flame. This bending is increased by the weight of the little glassy beads of fusible borates which, formed by combination of the ash with the boric acid in which the wick has been soaked, appear successively on the end of the wick and drop into the pool of melted stearine. By these devices both ash and carbon are disposed of and the candle needs little snuffing.

The stearine is melted in basins heated by steam from which it is dipped with spouted pails and poured into the molding machine. This consists of a double row of slightly-tapering tubes, in the axis of each of which a wick is kept taut by a pin above and a reel below. When the stearine has hardened the attendant opens the top of the machine, raises the row of molds with the aid of a train of wheelwork, passes a knife under it to cut the wicks, and removes the candles from the molds. The

candles are then trimmed to uniform length by a small and swiftly-moving circular saw and carried by an endless chain to rotating brushes which clean and polish them. After receiving the mark of the factory from a moderately-heated silver die they go to the packing room, where girls wrap them in paper and put them into boxes. Colored candles are made by the same process except that the desired color is mixed with the melted stearine, in steam-heated vessels, before molding.

Most French candlemakers manufacture, in addition to stearine candles, wax candles, night-lights and paraffined paper.

Wax, like tallow, has been used for illumination for centuries, but nowadays the high price of wax has almost abolished the use of wax candles in France, except in the ceremonies of the Roman Catholic Church.

In the manufacture of wax candles the wax is first bleached by spreading it in a thin layer on canvas and exposing it to the sun for several days. By repeating this process a second time a sufficient degree of whiteness is obtained. As no satisfactory method of preventing the adherence of wax to the mold has yet been devised, wax candles are still made in the old way, by pouring the melted wax on the wicks. The wicks are attached to a horizontal hoop suspended from the ceiling over a steam-heated basin of melted wax. The candle maker, with a dipper, pours a little wax over each wick in succession, repeating the operation until the candles have attained the desired thickness and testing their diameters, from time to time, by passing an iron or copper ring over them. When all the candles exactly fit the ring they are taken down, softened by plunging into warm water and rolled under a board on a table in order to make them truly cylindrical. In the bottom of each candle a little hole is made, with a wooden point, to facilitate its attachment to the chandelier.

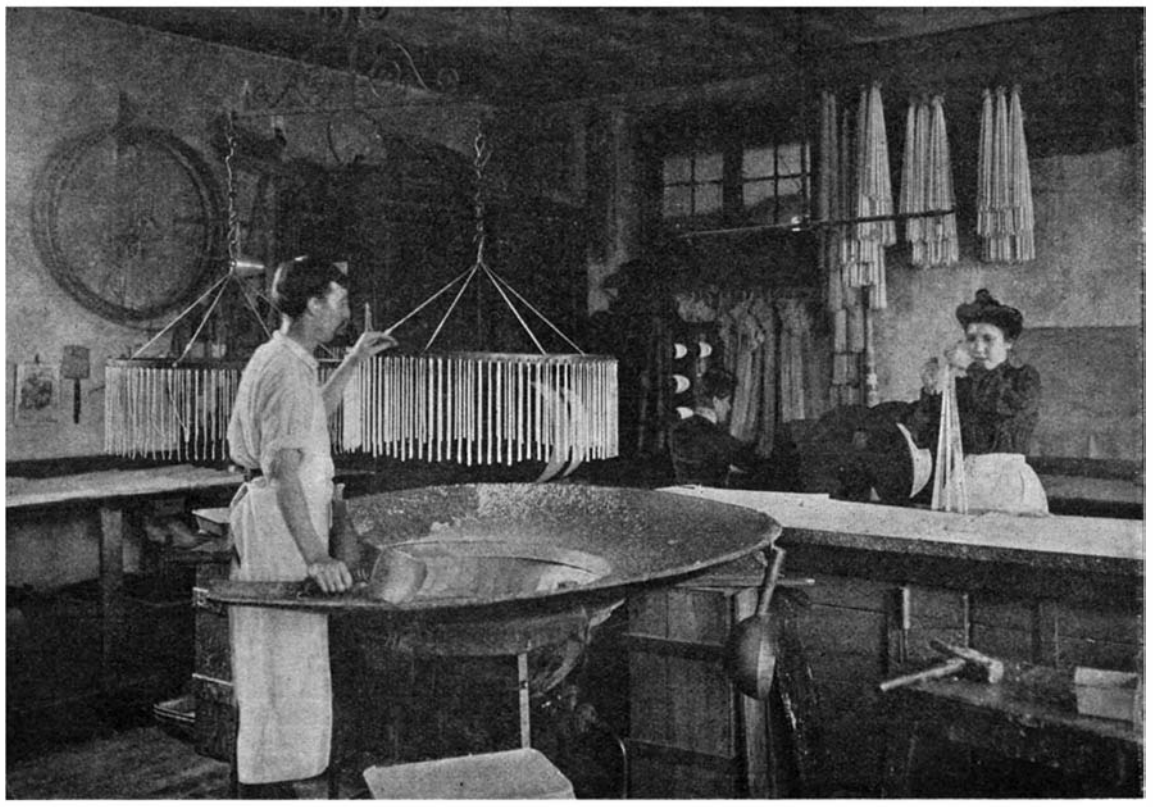


Fig. 9.—Making Small Wax Candles by Pouring.

In the manufacture of wax matches and the long and slender tapers which are known as "*rats de cave*" ("cellar rats") the method introduced into France by Pierre Blesmiare in the middle of the seventeenth century is still in use. One of the accompanying photographs illustrates the method as it is practised today in the Carrière factory, at Bourg-la-Reine, near Paris. The cords of which the wick is composed pass into a basin of melted wax heated by a small furnace, from which they are drawn through a perforated plate to a large wooden drum which is turned slowly by hand. The operation is repeated two or three times, the size of the hole through which the cord passes being increased each time. When the waxed cord has attained the required size it is wound on large reels in skeins of 400 or 500 meters (about 1,500 feet) which are boxed and shipped to wholesalers. It is also furnished in lengths of from 3 to 10 meters (10 to 33 feet) folded as often as may be required for convenient packing. These tapers are now used chiefly by wine merchants, and by sextons in lighting church candles.

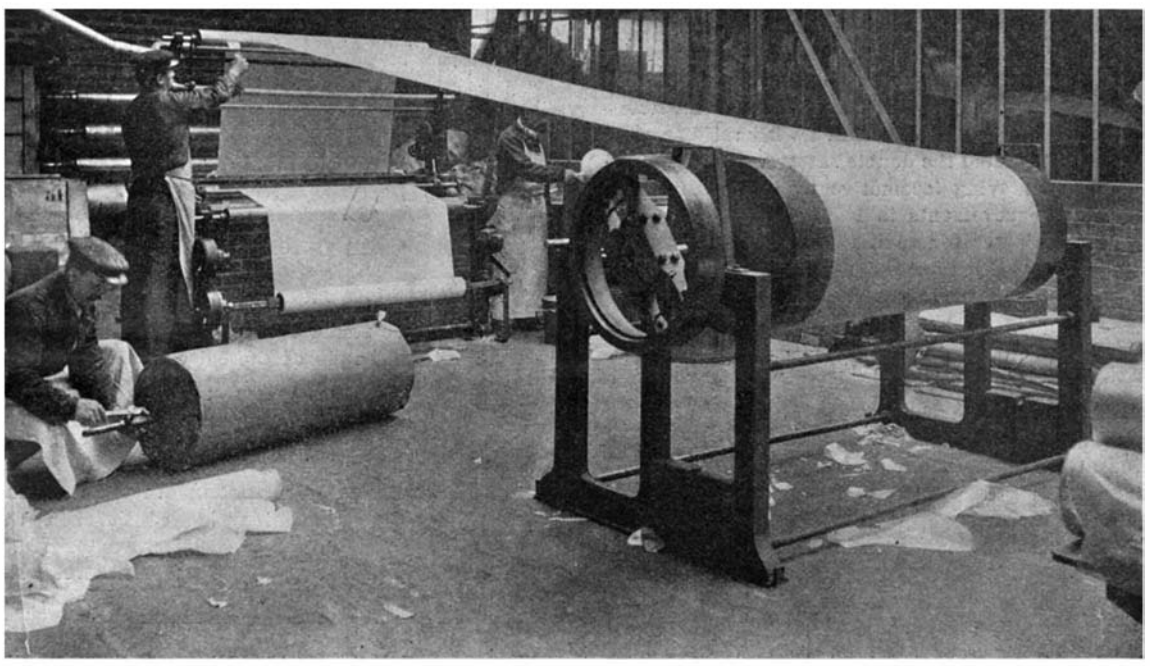


Fig. 10.—Preparation of Paraffined Paper.

The very short and thick candles called *veilleuses*, or night candles, are composed of a mixture of wax and stearine. The molding machine, shown in one of the photographs, differs considerably from the apparatus used for ordinary candles, although the principle of the operation is unchanged. After the little candles have cooled the attendant removes them from the molds and conveys them to women who put them into tin cups which prevent the escape of melted wax during combustion, and pass them to other women who label and pack them.

Paraffined paper is made simply by drawing long rolls of paper, by means of a series of cylinders, through a steam-heated trough containing a solution of paraffine and stearic acid, and thence to a large wooden cylinder on which it is rolled.

It is reported that an engineering firm at Pittsburg has patented a new type of universal plate mill. The mill will be driven by an electric motor of 6,000 to 8,000 horse-power capacity, this, it is said, being the first time that a mill of this character and size has been electrically driven.

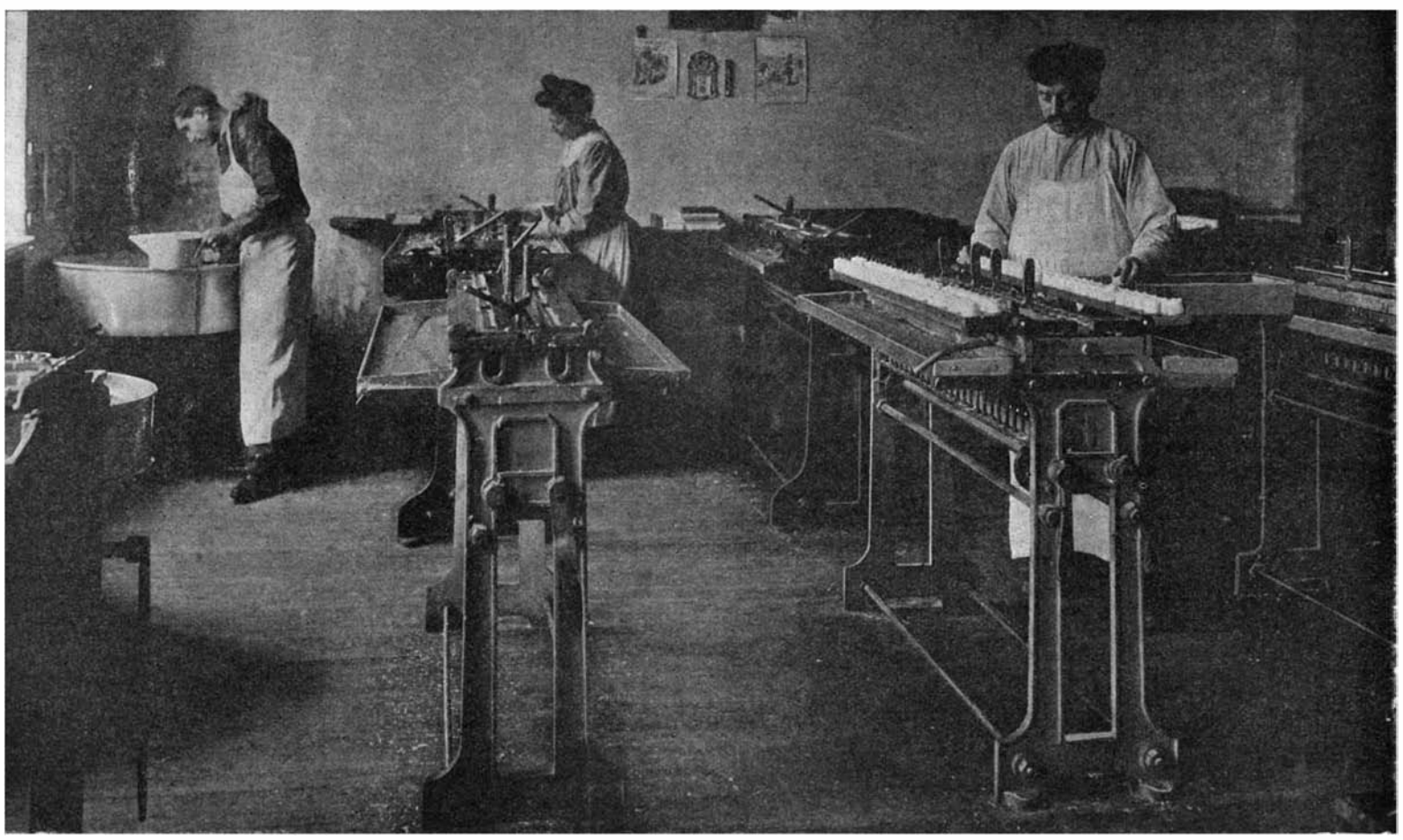


Fig. 6.—Molding "Carriere Veilleuses" or Night Lights.

THE MANUFACTURE OF CANDLES IN FRANCE.

Patent Department

Influence of Invention on Industry.

Sir William Bailey, a prominent English scientific writer, recently delivered a lecture before the Manchester Literary and Philosophical Society on the topographical distribution of men of genius in Great Britain. He stated that the county of Lancashire had produced a large number of inventors, who, during the last hundred years, had exerted a great influence on the prosperity of that country, and, indeed, had done more to change the face of the world by their mechanical contrivances than any other combination of inventors.

Sir William Bailey's statement is doubtless true to a certain extent; and it is to be deplored that, notwithstanding the universal good these Lancashire men wrought, all, with two exceptions, were subjected to ill-treatment at the hands of the communities they directly benefited, and died in poor circumstances.

It is interesting to note that in the first half of the seventeenth century Torricelli invented the barometer for indicating the pressure of the atmosphere, and in a few years the Marquis of Worcester and Savary followed their illustrious leader by introducing their experimental engines. After this nothing of importance took place until 1712, when Newcomen invented his simple vacuum or atmospheric engine, which did useful work for a hundred years before James Watt's double-acting engine, with the conical pendulum or governor balls for controlling it, became popular.

In 1700 England was not superior, nor even equal, to the manufacturers on the Continent. A small trade was done in iron, but all bar iron was imported. About this time the Dutch loom was introduced into Lancashire. Paper making had been introduced by foreigners in the reign of Henry VIII., and a few mills existed in the time of Elizabeth, but the best paper, used in the printing of books, came from France. From Holland came improved windmills and the waterwheel, while Dutch engineers were engaged in erecting pumps and providing water supplies, and the Norfolk Broads and the famous Bedford Level were also finished under Dutch management in the reign of Charles II. The goldsmiths of Bristol, York, and London did some good work; but in metal-work and in textile fabrics England was much inferior to foreign countries, both in design and manufacture. Soon after the commencement of the eighteenth century, Manchester and Liverpool increased rapidly in importance, and Manchester in 1720 obtained a bill for making the river Irwell navigable to the Mersey and to the sea. The increased facilities thus afforded gave a great impetus to the industrial prosperity of England.

A great demand for textile goods for export caused those engaged in the trade to desire means of increasing the production, and the fly shuttle, an invention that doubled or trebled the output of the weaver, came from Kay, of Bury, in 1733. Many other machines were invented by the unfortunate Kay, who was much ill-used by those whom he had benefited, and was obliged to leave Bury to save his life. He died in poverty and obscurity in France, the place of his burial being unknown. This new system of weaving quickly exhausted all the productions of the spinsters, for the new looms could use more weft and warp in a day than the spinsters could produce in a week. Inventors were thus naturally led to consider how to increase the production of the spinning wheel, the result being the invention of the spinning jenny. A careful consideration of the claims of James Hargreaves, of Blackburn, and Thomas Hayes, of Leigh, tends to prove that they invented the jenny simultaneously and independently. Between 1766 and 1769 Hayes produced one with six spindles, and, about the same time, Hargreaves made one with twelve spindles. The next important invention was that of Samuel Crompton, of Bolton. It was still found impossible to meet the demand created by the new loom, and, in the year 1775, Crompton invented the spinning mule. At this time, most of the fine yarns were imported from India, but by the year 1805 England began to export yarns to that country. Crompton was in great fear at one time because of the enmity of workmen, and in 1811 the government made him a grant of $25,000. At the commencement of the nineteenth century, many men were app'ying themselves to the driving of Kay's loom and Crompton's mule by steam power, but it was reserved to two Stockport manufacturers, Radcliffe and Horrocks, to invent the first practical steam loom, in 1805. This produced a famine in yarn which continued until 1834, when the self-acting mule was invented by Richard Roberts. It is now used extensively all over the world, and it is one of the inventions that have placed Lancashire manufacturers in the front rank. Roberts was one of the greatest mechanical inventors of the nineteenth century. Although he never went to school, he was an accomplished mathematician and draughtsman, and would never permit experimental work to proceed until high-class detailed drawings were prepared. Among his many devices may be mentioned the slide lathe, the metal planing machine, the pentagraph automatic drilling machine, and the Jacquard punching machine. Although the men of Manchester agreed to allow him $5,000 a year if he would come to live in that city, he died in poor circumstances in London, and was buried in Kensal Green Cemetery.

William Sturgeon, the inventor of the electric magnet, was born near Lancaster. He enlisted in the army, and while undergoing his training he began to study thunderstorms, lightning, and electricity, and in 1825 presented to the Society of Arts his first soft iron electro-magnet, for which he was awarded a premium of $150 and a silver medal. He started the Annals of Electricity, to which all the foremost inventors of the age contributed. His life, however, was one perpetual struggle with adversity, and, in 1850, the Bishop of Manchester and the Literary and Philosophical Society of Manchester petitioned the government on his behalf, obtaining for him a grant of $1,000 and an annuity of $250, which, unfortunately, he only lived to enjoy a few months.

Great improvement in the quality of manufactured iron was effected by the invention of the puddling furnace by Henry Cort, of Lancaster, in 1784. Its object was to remove the impurities of English iron, and its success was immediate and remarkable. Cort also made rolling mills with grooved rollers, and his inventions gave a great impetus to the production of iron, which rose in two years from 90,000 tons to 5,000,000 tons per annum. He died poor and neglected. Among other prominent inventors the name of James Joule, who was born in Salford, may be mentioned. In addition to discovering the mechanical equivalent of heat, he was the first to invent electric welding, and his investigations in electricity generally have been considered of considerable scientific value. The patent lever watch was not invented in France, as has been asserted, but by Litherland, of Warrington, in 1791. The name of John Ramsbottom is well known in connection with railway engineering. He invented the double safety valve, the method of feeding moving locomotive tenders with water, made many improvements in looms, and designed the condenser lubricator for engines. His most important invention was the "weft-fork" for steam looms, which was the means of greatly increasing the productive power of the weaver.

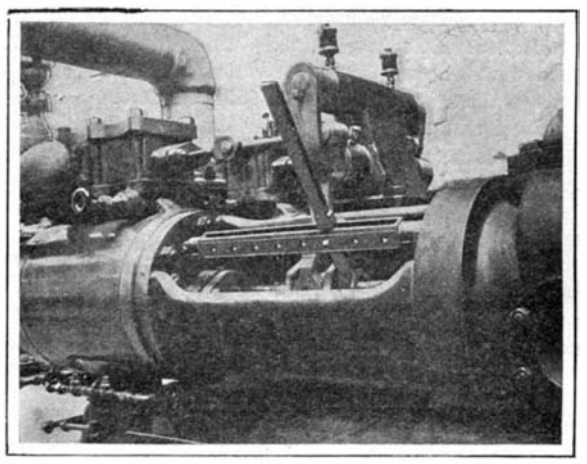
A Fire Shield.

A Southern inventor has made improvements in a fire shield, which if it can be dropped or moved into position at the proper or critical moment will be a decided practical gain in fireproof construction for use as a barrier in proscenium arch openings of theaters. The shield is embraced by and vertically movable in trough-shaped guides, and is provided with any suitable suspension device. It comprises two skeleton frames, each preferably consisting of a number of metal bars or strips, which intersect at right angles, the meeting and crossing portions being rigidly connected by stove bolts. By this construction a large number of panels are formed, each closed by a pane of mica, the panes being clamped between the two curtain frames. On the breaking out of a conflagration, it is only necessary to place the shield into position, when between the stage and the auditorium a transparent mica obstacle is interposed. This permits the firemen and attendants to intelligently direct their work to prevent the spread of flames or to extinguish them. The transmission of light through the mica illuminates the theater in case the usual lights are put out of use, and provides ample means for actors or audience to see their way to safety. The shield is rigid in every part, and where it has been moved into place to close the arch opening, no amount of heat short of that which is sufficient to melt or fuse the steel framework can operate to effect the most minute passageway for the escape of flames, gases, hot air, or any products of combustion. In this particular it is an improvement over asbestos curtains, that are blown away at the sides or edges from the stage opening by the force of heated drafts common to theater fires. At the lower edge of the shield is attached a tubular rib, compactly filled with a packing composed of powdered mica and asbestos. It affords great rigidity to the sheld, and effectually resists the action of the hot air and flame, which seek to gain egress underneath the shield. The shield may be made also in the manner of a pair of sliding doors, which may be arranged to slide from opposite sides of the stage.

James L. Branson, the inventor of the knitting machine which bears his name, was found dead in the stable attached to his residence at Doylestown, Pa., some weeks ago, having been killed in some manner by a horse. His knitting machine was invented during the civil war, and it is said to have yielded him a profit of $60,000 in three months.

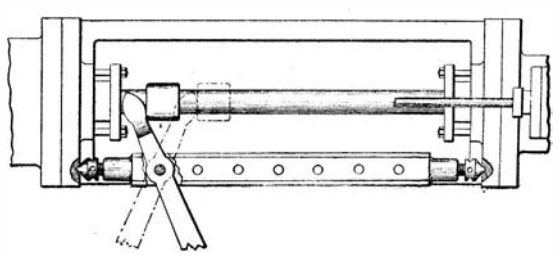
DEVICE FOR MOVING PUMP PISTON RODS.

A very useful device has recently been invented for moving or adjusting a pump piston rod while setting



DEVICE FOR MOVING PUMP PISTON RODS.

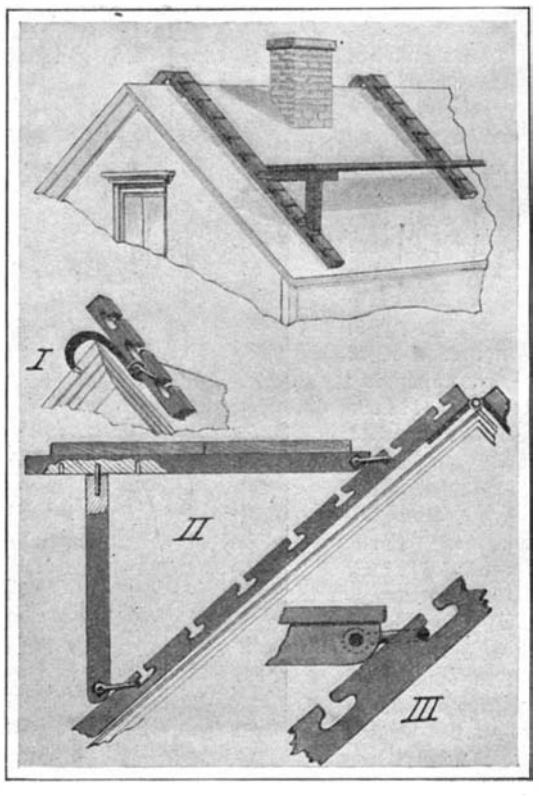
the valve therefor. The device will enable an engineer to place the pump piston rods at any desired position, to faciiitate the packing of the stuffing boxes when it is necessary to remove the gland or follower, or in order to set the pump valves when the piston must be moved to a central position. The device comprises a longitudinally slotted fulcrum bar, the opposite members of which are perforated to receive a fulcrum pin on which the operating lever is mounted to swing. This lever is provided with spaced or forked members, adapted to receive the piston rod and engage the driving block thereon. The piston rod, as is usual, connects with the plunger in the piston cylinder, and with the piston in the steam cylinder. Adjusting bolts are threaded into the ends of the fulcrum bar, and their pointed heads engage depressions in the cylinder heads. The position of the lever with relation to the fulcrum bar may be changed by simply removing the fulcrum pin, and passing the latter through another pair of perforations. When not in use the lever may be removed and placed alongside of the bar, thus taking up but very little room. The inventor of this device is Mr. Hans Linke, 312 West 123d Street, New York, N. Y.



DETAILS OF THE PISTON ROD MOVING DEVICE.

IMPROVED SCAFFOLDING.

A novel form of scaffolding has recently been invented, which is particularly adapted for use on roofs of buildings. It will be found very convenient when repairing chimneys or doing other work on a roof, as it may be easily handled or placed in position, and when not in use it can be compactly folded for storage or transportation. The scaffolding comprises a pair of bars, each consisting of two sections which are

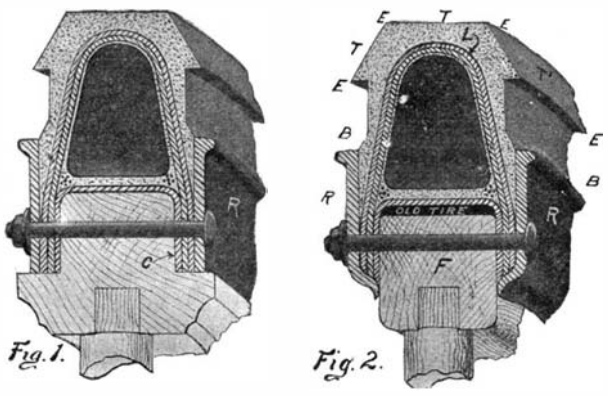


IMPROVED SCAFFOLDING.

hinged together. In use the bars are passed over the ridge of the roof, with the sections resting against opposite sides, as shown by Fig. II. in the accompanying engraving. The sections, it will be noticed, are provided with under-cut or T-shaped notches, which are adapted for engaging links or loops used in supporting brackets. The upper or horizontal member of each bracket consists of a bar with perforations in its under side, and the vertical member of the bracket carries a pin at its upper end, which is adapted to engage one or other of these perforations, according to the pitch of the roof. The method of linking the bracket bars to the notched bars is clearly illustrated in Fig. III. When the brackets are in position, a scaffolding plank is supported on them. In some instances it may be necessary to use the bars at their full length on one side of a roof; that is, to reach from the peak of the roof to the gutter. In such a case hooks are used, which are connected to the bar by a loop, and these hooks are adapted to engage the peak of the roof, as indicated in Fig. I. As the notches in the bars are of T-form, it is obvious that the bars may be used either end up. Mr. John Emberson, 43 North Lexington Avenue, White Plains, N. Y., is the inventor of this improved scaffolding.

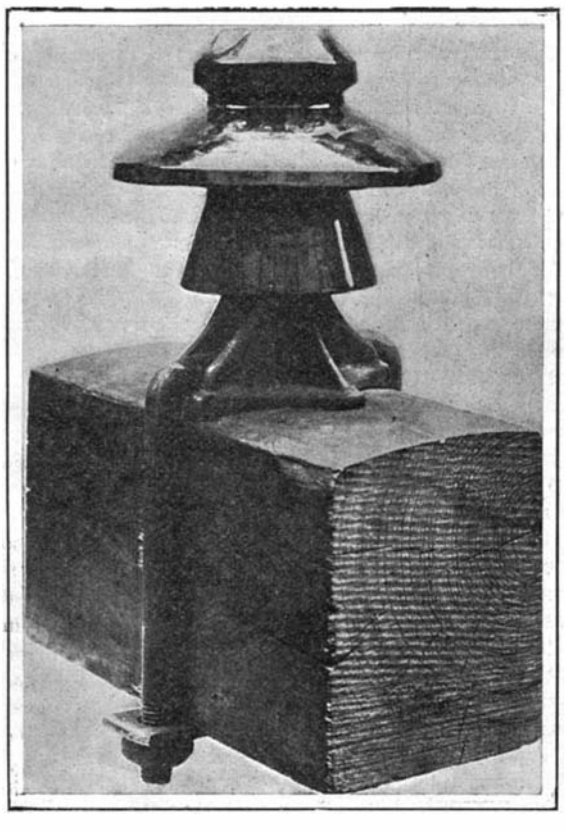
AN IMPROVED NON-SKIDDING TIRE.

Motorists all know that the greater percentage of automobile accidents are due to side slipping or



AN IMPROVED NON-SKIDDING TIRE.

skidding. It is to eliminate as far as possible this dangerous feature that the tire herewith illustrated is designed. The tire depends for its action on the fact that a square-edged piece of rubber cannot be made to slip on a smooth or wet surface. Fig. 2 shows a tire as fitted to an ordinary wagon wheel, it being necessary only to bore a few holes through the felloe for the bolts which serve to hold the rings. The illustration shows the original iron tire still in place, which allows of using the vehicle with or without rubber tires as desired. This type of tire is particularly adaptable to ambulances, undertakers' wagons, and delivery vehicles. The surface *T* represents the normal tread surface. Upon rounding a curve the tendency would be to bring the secondary tread surface *T'* in contact with the roadbed. This interposes the edge *E*, which under ordinary conditions is calculated to prevent skidding. Should the speed be unusually great, or the curve very short, there is still a secondary edge *E'* to be called into play. The foundation layers of supporting fabric are designated by *L*. They serve to resist the force exerted at *E* when said edge is brought into commission. The rubber buttresses reinforce the walls and protect the tube from the rings. The tire is bolted to the felloe *F* by means of metal rings *R*. These rings also give support to the walls of the tire. In Fig. 1 the tire is shown as adapted to a specially-designed rim for automobile use. A metal cap *C* may be fitted over the felloe, so as to permit riding home on the rim without injury to the same in the event of serious accident to the tire. The positive mode of attaching the tires is an important feature of the invention. Owing to the unusually heavy construction about the air space, the tire is less liable to be punctured. The flat tread is an ideal one, because it presents a maximum friction surface for the roadbed. As a matter of fact, the so-called round tread is really flattened out as it bears the weight of the car, and this constant bending soon tells on the tire. The improved tire may be as easily repaired in case of puncture as other types; for the rings may be removed without jacking up the axle. Dr. John K. Broderick, of 805 North Main Street, St. Louis, Mo., is the inventor of this improved tire.



A NEW INSULATOR PIN.

A NEW INSULATOR PIN.

In the description of the transmission line and third-rail system of the Long Island Railroad published in our issue of June 9, mention was made of a new type of iron insulator pin employed. This pin, which is a radical departure from previous practice in pin design, is the invention of Mr. W. N. Smith, of Westinghouse, Church, Kerr & Co., who has applied for a patent on the device. The new pin combines several important advantages, as follows: It does away with the necessity of boring holes in the crossarms, thereby conserving the whole strength of the arm and lengthening its life; the metal composing it is distributed in the most effective manner possible, as its cross section is greatest next to the arm where the greatest resistance to bending is required; and finally, the shrinkage of the arm can more effectively be taken care of by the U-bolt and strap than by any of the other forms of pin fastening in common use, as there is no tendency to distort the bolt, and consequently, there is no possibility of the pin standing crooked upon the arm after the shrinkage has been taken up. Furthermore, it is practically indestructible, and instead of being one of the weakest factors in line construction, this pin is expected to be the strongest.

More than 8,000 of the pins, as originally designed and shown in the accompanying illustration, were used in the transmission line construction of the Long Island Railroad, carrying 250,000 circular mil cables in spans averaging 150 feet in length, and no failures have yet been reported after over a year of service. A dozen or more standard sizes of the improved design are being worked up to fit several sizes of crossarms and pole tops, and to carry insulators of varying sizes up to the highest voltages in practical use. The pins will be made of either cast or malleable iron to suit different conditions, and will it is believed fill a long-felt want for a pin which combines at a reasonable cost the maximum of strength and durability both in itself and in the crossarm to which it is fastened. While it is designed particularly for use with wooden crossarms, it can readily be adapted to steel crossarms, and to such special fixtures as are often necessary in heavy transmission line construction. On account of its superior mechanical design, it will also without doubt find a place in heavy catenary trolley construction, which is now being actively developed for the electrification of railways by the single-phase system.

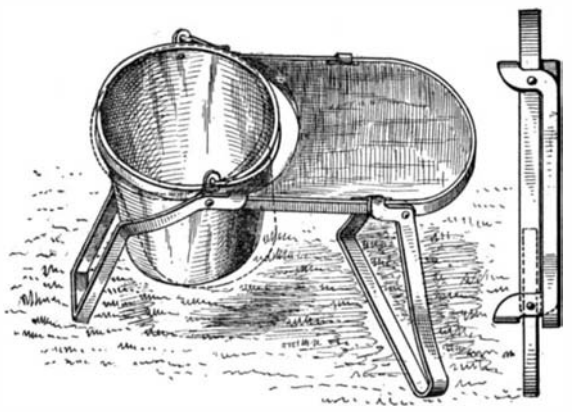
A New Trolley Car Headlight.

Ora E. Mitchell, the conductor of a Los Angeles street car, has devised a very successful headlight for trolley cars, which is under entire control of the motorman. There has been a demand for a light of this kind for use on suburban lines and those which have many curves. The headlight of the ordinary type, which is rigidly fixed to the dashboard, projects its light off at an angle when rounding a curve, and the track in front of the car is without any illumination whatever. The light invented by Mr. Mitchell is mounted in such a manner that it may easily swing from one side to the other, and is controlled by pneumatic pressure. The means of control is under the motorman's foot, and by a mere pressure of the toe he can direct the beam just where it is desired. The apparatus has been given a severe test in practice, and has been found to be a great improvement on the old form of light. This headlight will be adapted for use on automobiles as well as street cars.

A great improvement has been recently made in the machinery for making seamless hosiery. Under the old system, the rib or upper portion of the hosiery was made on one machine, the circular leg work on another, and finished on a third, but by the new machine the work is performed from start to finish in one operation. The new machine begins on the rib work, and automatically changes to the circular leg portion, then it makes the heel, foot, and toe, and starts on another piece without any intermission.

ODDITIES IN INVENTION.

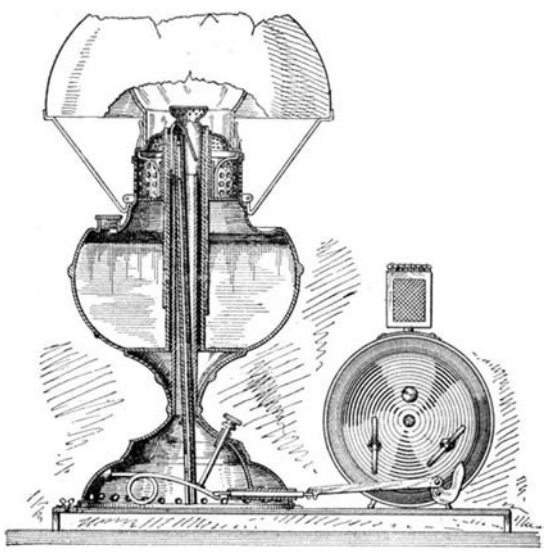
FOLDABLE MILKING STOOL AND PAIL HOLDER.—A very convenient device for the farm has recently been invented by a resident of Iowa. It consists of a milking stool which can be folded when not in use, and a pail holder attached to the stool, which can be adjusted to suit the convenience of the user. The frame for the



FOLDING MILKING STOOL AND SEAT HOLDER.

pail consists of a spring clasp, which permits the pail to be inclined toward the cow, if desired, or moved to an upright position to prevent spilling the milk. The pail is held in the position at which it is set by the frictional contact of the clasp.

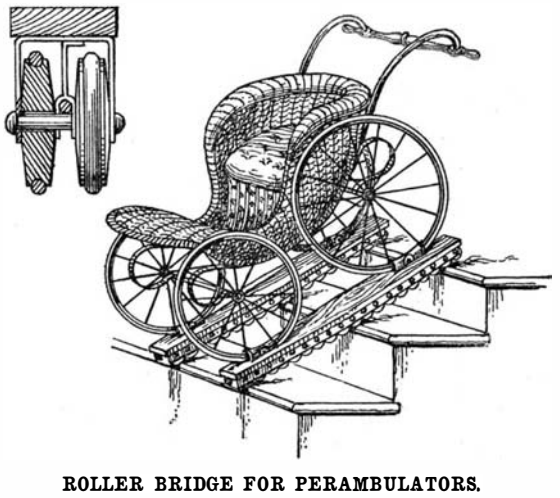
TIME-CONTROLLED LAMP.—A resident of Georgia has invented a combined lamp and alarm clock, which is so arranged that the lamp will be automatically lighted when the alarm goes off. The lamp is of the center-draft type, and in the central sleeve is a tube which carries a plunger with a match in its upper end. The plunger rests on a strong spring, which is held under tension by a trigger connected with the alarm mech-



TIME-CONTROLLED LAMP.

anism. When the alarm is sounded the trigger is sprung, and the match is forced up against the wick of the lamp. In its course the match is ignited by friction, and the lamp is thus lighted. The value of this device when the alarm is set for some hour of the night or early morning will be appreciated. It is often desirable in the sickroom that the attendant be awakened to administer medicine at certain hours of the night without disturbing the patient. In such case the bell of the alarm may be muffled, and the trained attendant can then depend on the sudden flash of light to awaken him at the proper hour.

ROLLER BRIDGE FOR PERAMBULATORS.—The long-felt need of something to assist in moving baby carriages

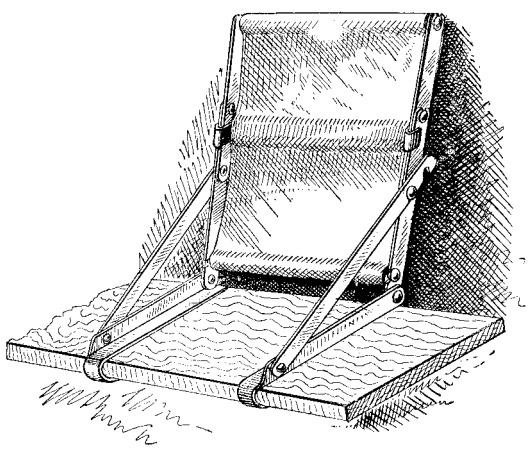


ROLLER BRIDGE FOR PERAMBULATORS.

up and down stairs or steps has at last been met by the roller bridge which we illustrate herewith. As the name implies, the device consists of two bars

mounted on rollers, and to which the wheels of a perambulator can be readily attached. The perambulator thus mounted can then be rolled smoothly downstairs with no bumping or jarring of the infant occupant, as the bars are long enough to always bridge or span at least two steps. To make the bridge noiseless, the rollers are preferably rubber-tired, as indicated in the small detail view.

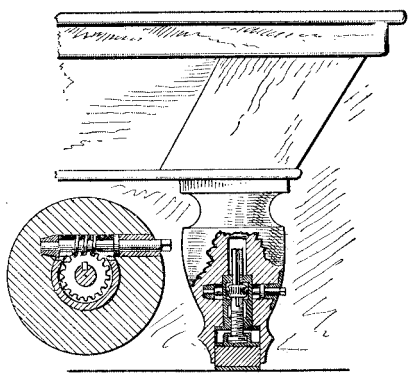
FOLDING SEAT BACK.—In these days of vacation trips,



FOLDING SEAT BACK.

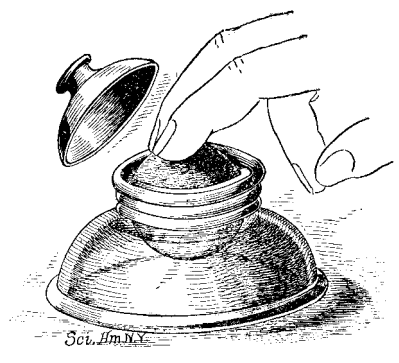
the advantages of a simple seat back for use in the camp or in a boat will be appreciated. Such a device is illustrated herewith. It consists of two seat bars and two back bars hinged together, and adjustably connected by a diagonal brace. A canvas back is arranged to be hooked into slots in the back bars. The seat bars are formed with hooks at their forward ends, which can be slipped over the edge of the seat to hold the seat back in position. When not in use the device can be folded into a very compact bundle. It will be found particularly useful on the bleachers at the baseball park or the plank seats of a country circus.

BILLIARD TABLE ADJUSTMENT.—It is essential for good playing that the top of a billiard table should be perfectly level, but owing to the vibration and settling of buildings, and to the changes of the temperature which are constantly going on, the required condition of the table top is maintained with great difficulty. A means by which the billiard or other table may be easily regulated is shown in the accompanying illustration. It consists of an apparatus for raising and lowering the corners of the table, the mechanism being buried in the legs of the table. A large chamber is provided at the bottom of the table leg into which a block is fitted. This block is moved vertically by a worm gearing turned by a shaft, which protrudes from the sides of the table leg. The shaft is the only part of the device which is visible. The construction of the apparatus is clearly shown in the accompanying illustration.



BILLIARD TABLE ADJUSTMENT.

FINGER MOISTENER.—An exceedingly simple and convenient finger moistener, for use when handling paper money or counting and arranging papers, is illustrated in the accompanying engraving. The ordinary moistener consists of a wet sponge in a cup, but the objection to this type is that it soon becomes dry from evaporation, also that it will collect dust and soil the fingers. The present invention avoids these objectionable features. It consists of a receptacle or reservoir with a wide mouth in which a ball is loosely fitted. The ball floats on the water of the reservoir. In use the fingers are placed lightly on the ball, and moved in any direction to turn up a moistened surface. Owing to the fact that the mouth of the reservoir is nearly closed, evaporation will be very slow indeed, and a single filling of water will last for a long time.



FINGER MOISTENER.

Brief Notes Concerning Patents.

An association of inventors which has adopted the name of the International Congress of Inventors has been formed, with Rochester, N. Y., as its headquarters. George H. Gallagher, of that city, who was one of the most active spirits in the organization of the body, has been elected president. Its object is the protection and advancement of the interests of the inventors of this country, and an effort will be made to effect similar organizations in the other principal cities of the country. When a firm footing has been secured, it is proposed to bring about certain changes in the patent laws, which are not regarded as satisfactory to the interests of the inventors.

A new kind of carpet has recently made its appearance on the market, and from the standpoint of the consumer at least, it has a number of excellent qualities to recommend it. It has many of the characteristics which have heretofore been the sole property of the very high-grade carpet, whereas this new article is sold at a very reasonable price. The new material is known as Cushion-Wilton, and is made by the introduction of a quantity of material between the back of the carpet and the pile. This, of course, increases the thickness of the carpet, and imparts an elastic tread which has heretofore been attainable only in the finest grades of floor covering. At present it is made only in the shape of rugs of the standard carpet sizes.

A shadow of questionability was thrown over the process of enriching the soil through inoculation by nitrogen cultures, by the scandal attending its introduction and distribution by the Agricultural Department, and this was increased by the fact that an unfortunate error was made in the manner of packing the material for shipment. Raw cotton was used, and was allowed to come in contact with the fertilizer, and this is said to be responsible for a grave deterioration. The results were not at all satisfactory. An improvement has been recently made in the manner of packing the nitrogen cultures for transportation which will, it is said, improve the keeping qualities, and guarantee better results to those who make use of the fertilizer. The new package costs a trifle more than the old one, but the superior results will justify the increased expenditure.

The citizens of Brantford, Canada, recently tendered a dinner to Alexander Graham Bell, who lived at that place at the time when he perfected the telephone, and a movement is on foot to purchase the old Bell homestead, which it is proposed to turn into a public institution. It is also proposed to erect a monument in the city of Brantford, the whole to cost about $35,000 or $40,000. This is done with the view of securing authoritative recognition of the fact that the birth and development of this invaluable instrument took place at Brantford. It is claimed that the telephone was invented there in 1874, and that the first transmission of speech over a telegraph line took place in 1876 over the lines of the Dominion Telegraph Company. The first experiment took place over a distance of about five miles between Brantford and Mount Pleasant. The Prince of Wales is one of the patrons of the movement.

A curb conduit system, by which the inventor says the accumulations of dirt and snow which are one of the problems of a great city will be disposed of almost automatically, has been worked out by James C. Marriot, a resident of Brooklyn, N. Y., who has been awarded a patent on the same. It contemplates the use of a large surface drain, such as have not been in use for many years, but the inventor provides for a covering of metal, which will remove the objection of unsightliness. At regular intervals a connection is made with the water supply, so that this drain may be flushed as desired. It is proposed to employ sweepers as at present, but instead of sweeping the dirt in piles for removal by cart, the men will simply direct the sweepings to this drain, and raising one of the plates, dispose of the dirt and replace the lid. The stream of water may be in operation all the time, and in this event the dirt will be carried away at once; but where it is not possible to be so lavish with the water, it may be turned on at stated intervals, which will have the same effect in conducting the accumulations away.

A great deal of attention has been attracted recently to the process of extracting the precious metals from their ores which has been discovered by Dr. John A. Just, of Syracuse, N. Y. A company with a capitalization of one million dollars has been formed for the purpose of exploiting the invention. The process is said to be entirely revolutionary in its character, and has not been anticipated in any particular by any other processes, and the great advantage claimed for it is that the operation of recovering the precious metals is greatly simplified, and the necessity of roasting the ores is wholly obviated. Instead of this a much shorter method of arriving at the same result is made use of, the mass being dissolved in chemicals and the metal recovered from the precipitate. The chemicals are capable of being recovered and made use of over and over again, so that the process is economical as well as rapid. A big reduction plant will be erected at Tonapah, Nev., the center of one of the western gold fields. Dr. Just is an inventor of wide repute and a scientist. He is said to be the holder of 170 patents, of which he is the originator, and about 100 of these are said to be practical successes. One of the new processes for which he is responsible is a method of reducing milk to a powder, and there are a number of establishments in different parts of the country at the present time making use of this discovery.

The big sight-seeing automobile designed to facilitate the inspection of a city by visitors proved a success from the start, and at the present time these cars are to be seen lumbering through the streets of all the principal cities of the world. But a spell of inclement weather has a very serious effect on the profits derived from the machine, while the item of maintenance goes on just the same as if the vehicle were making regular trips with full loads. A patent was recently secured by Timothy C. Hurst, of New York, N. Y., covering an interesting and somewhat amusing system, by which the profits and possibilities of such tours are greatly increased. Neither the weather nor any other conditions should interfere with the big auto, for the reason that the tours are made without moving from under a protecting roof. But notwithstanding this, the passengers will find that few of the thrills and sensations of a real trip around the city are missing. The scheme consists of a combination of an anchored automobile and a projection lantern, which enables the tourist to enjoy all the delights of a ride without any of the uncomfortable features sometimes attending a real experience of this character. The automobile body is suspended from the ceiling, and is without wheels or running gear of any kind. The only bit of machinery present is a motor, which imparts a series of vibrations resembling the bumps that would be encountered by a passage over the rough streets of a city. This delusion is heightened by a side tilt, which is given to the car to simulate the rounding of a street corner. As the car does not move, it is necessary to have the landscape pass in review, and to the tourists reposing in their comfortable seats, there is an ever-changing picture in front of them. This consists of a series of rapidly-made views, secured by covering the route of the alleged trip with a camera mounted on a car. These are subsequently projected on the screen in front of the big auto. It is thus possible not only to make a tour of the city in which the new amusement feature is located, but it is proposed to present a varied programme, so that it will be possible to make similar tours of other cities and localities of interest.

Among the recent occasional attempts at utilizing the heat of the sun for power purposes is the recent invention of a Frenchman for a thermo apparatus for raising fluids. It is founded on the principle of expansion and contraction of gases according to variations of temperature and makes use of the difference in temperature during night and day to effect its purpose. In a well, cistern, or the like, containing the fluid to be raised, a closed vessel provided with an inward opening valve, is entirely submerged. Another closed vessel of greater capacity is placed where temperature is subject to variation, e. g., in front of a wall exposed to the sun. This vessel may be partially surrounded by a curved reflector to increase temperature by radiation. In the interior of this exposed vessel is a small reservoir over which is fitted a rubber bag, and the reservoir is provided with a cock through which any volatile fluid such as liquid ammonia can be introduced. A pipe connects the two vessels, and another pipe, projecting down to the bottom of the submerged vessel, is conducted to the reservoir to which the water is to be supplied and acts as a delivery-pipe. The operation of the apparatus is as follows: The reservoir-cock is first opened, permitting the water to enter through the valve in the submerged vessel and ascend until it is at the same level as the water in the well, pressure being the same in both vessels. Liquid ammonia is then sent into the reservoir through the cock (such an amount that it cannot volatilize and that its vapor is kept in a state of saturation) after which the cock is shut. As the day temperature rises the pressure of ammonia-gas increases, the bag expands and fills the interior of the exposed vessel, and the air in this latter is thus forced down into the submerged vessel, the water rising in and escaping out of the delivery-pipe. A floating-valve device is so mounted on the inner end of the delivery-pipe that it closes when the level of the water in the submerged vessel sinks to its lowest point, and prevents it from quite emptying itself. At night with falling temperature, the ammonia-gas pressure sinks and the gas liquefies, the bag takes its initial form, and in consequence of the pressure in the submerged vessel the water in the well finds its own level into the submerged vessel, and the next day the operation is repeated. This takes place daily or any time that the heat of the exposed vessel varies.

RECENTLY PATENTED INVENTIONS.

Pertaining to Apparel.

COMBINED BUTTON AND PIN FASTENER.—R. ELLIS, Niagara Falls, N. Y. The object had in view in this case is to provide an attachable button which shall be specially adapted for use as a skirt-supporter and fastening means for the skirt-placket, the device to be equally adapted for affording ready replacement of a detached suspender-button and for other obvious uses.

BELT.—J. ASKEW, West Point, Miss. The invention has reference to wearing-apparel, and its object is to provide a new and improved belt arranged to properly support the trousers or other garments without exerting undue pressure on the stomach of the wearer. The ends are connected in a manner to maintain the usual appearance of an ordinary belt and to serve as ornaments.

Of Interest to Farmers.

COMBINED HARROW AND CULTIVATOR. M. TRUE, Watervalley, Miss. This improvement comprises the combination, with two like triangular frames provided with teeth and spaced apart and flexibly connected and provided with pendent bars, of wheels having axles provided with sockets adapted to receive and slide upon the bars, and clamp-screws applied for securing the sockets in any required adjustment, the wheels being arranged parallel in the inner sides of the frames.

MACHINE FOR LOADING SHOCKS.—W. O. CRAWFORD, Beaver Creek, Minn. A purpose of this invention is to provide a portable and readily-operated machine for loading shocks of corn or cornfodder onto wagons or for stacking the shocks or for moving them from the stack to the wagon, which machine may be used with equally good results for loading and stacking manure, hay, straw, and all kinds of fodder.

Of General Interest.

EMBROIDERY-SILK HOLDER.—J. J. LAWLER, Winsted, Conn. In this case the object is to provide a new and improved embroidery-silk holder arranged to securely hold a skein of embroidery-silk and to allow convenient removal of a single thread from the skein without danger of tangling the threads forming the skein.

HOLDER.—J. P. MERLINE, Oconto, Wis. This holder is particularly adapted for the support of paper bags. The objects of the inventor are to provide a simple and convenient device. In use the bags are drawn from the bar and when all have been used the device may be conveniently removed by means of its center loop projection and another supply placed upon it.

SURGICAL APPLIANCE.—W. L. WOODRUFF, Troy, Arizona Ter. The purpose of the improvement is the provision of a hood or cover for the part, especially designed to be used as an aid in the cure of venereal diseases and to so construct the device that it can be readily applied and removed and worn with comparatively little discomfort.

UNDERTAKER'S MITTEN.—F. J. PRIBIL, JR., Appleton City, and J. N. UTTERSON, Montrose, Mo. The invention is a mitten for use to facilitate the dressing of corpses. In drawing a coat on a corpse the cuffs and shirt-sleeves slip back on the arms and are hence not in proper position when the operation is completed. By the aid of the mitten this result is avoided and the operation of dressing is more quickly performed.

KILN.—A. P. BROOMELL, York, Pa. The arrangement of the furnaces with respect to the stack provides for the efficient utilization of all the heat and for application thereof evenly throughout the extent of the interior of the stack, thus securing a uniform burning of the rock and consequently superior quality in the product. Means are provided to permit application of heat to the rock near the outer part thereof, and to avoid overburning of the central portion of the rock. At the same time, however, enough heat is directed upon the center to prevent formation of an unburned core.

Hardware.

COMBINED RATCHET WRENCH AND DRILL.—J. R. NEILSON, Union City, Tenn. The principal object in this case is to provide a device which affords a very positive grip upon the tool or other member gripped thereby, and which is provided with a reversible ratchet operating mechanism by means of which the wrench and drill may be positively rotated in either direction about its axis of rotation.

HOOK-LOCK.—F. LILIGER, St. Joseph, Mo. The invention relates to a device intended for locking or closing hooks, so that an article engaged therewith cannot be accidentally disengaged. The invention is particularly intended for use in connection with tackle-hooks, although it may be employed for other purposes.

CALIPERS AND DIVIDERS.—G. C. SMITH, St. Kilda, near Melbourne, Victoria, Australia. Mr. Smith has devised this invention in order to provide simple and inexpensive means for locking calipers and dividers in position and incidentally for enabling calipers to be used to measure accurately in positions from whence it is not possible to remove them in order to transfer the measurement without slacking them back.

Household Utilities.

SHADE AND CURTAIN BRACKET.—W. J. CONNELL and L. C. LOWE, Huntington, W. Va. The invention pertains to improvements in shade and curtain brackets, and has for its object to produce a simple, cheap, and efficient bracket that can be readily and quickly applied to and removed from a window-casing and one from which a short ventilating-shade in addition to a lace curtain and window-shade may be suspended.

BED-RAIL JOINT.—J. MURPHY, Kenosha, Wis. In this instance the invention refers to improvements in corner joints or fastenings for the rails of metal beds, the object being the provision of a joint that will be comparatively cheap to manufacture because of the small amount of metal required for the desired strength. The rails readily engage without employing screws or bolts, forging, bending the rail, or without a casting on the rail.

Machines and Mechanical Devices.

WASHING-MACHINE. — G. H. WISNER, Pioneer, Mont. In this patent the invention relates to improvements in washing-machines, the inventor's object being to provide a machine by means of which garments may be rapidly and thoroughly cleansed. In operation the water is kept in practically constant agitation. Means are provided to relieve the turn-table from undue shock when it is moved by means of the springs.

CLUTCH AND TRANSMISSION-GEAR.—J. W. WALTERS, New York, N. Y. One object in view of Mr. Walters is to combine in one structure a two-speed or differential transmission-gear and a clutch device adapted to control the starting and stopping of the machine to which the new device is applied. A further object is to compactly arrange the several parts to make them take up a very small amount of space on a motor-vehicle or any other form of machine or apparatus.

FIBER-CLEANING MACHINE. — A. G. PONS, Mexico, Mexico. In this patent the purpose of the invention is to construct a machine for decorticating plants, especially sisal hemp, and to provide a machine which will expeditiously remove the pulp from the fiber in a thorough and cleanly manner and without detriment to the fiber. After material is fed thereto the machine is practically automatic in its action.

MEASURING-MACHINE. — S. O. MYERS, Mount Vernon, N. Y. The invention of Mr. Myers has reference to measuring-machines, and his more particular object is the provision of a coin-controlled machine for measuring the heights and for indicating the normal weights of persons. Repeated use upon payment of a single coin by a number of persons successively stepping upon the platform without allowing the movable parts to resume normal position, is prevented.

BALL-BEARING.—R. CONRAD, 248 Kurfurstondamm, Berlin, Germany. Provision is made in this invention for a ball-bearing having concentric-grooved rings, the sides of the grooves being uninterrupted throughout their circumference and the parts being so proportioned and designed that the balls may be admitted to grooved space by displacing the rings relatively to each other. The term ball-bearing is to be understood as including various other known equivalent devices rolling between the rings.

Prime Movers and Their Accessories.

CARBURETER FOR GASOLENE-ENGINES. R. A. MIDDLETON, Rexburg, Idaho. The essential object of the improvement is to provide devices for furnishing an auxiliary air-supply, so that when the engine runs at excessive speeds an increased quantity of air will be permitted to pass through the carbureter, thus maintaining the correct proportions of air and fuel. It is designed for use especially in connection with internal-combustion engines, but may be used for other purposes.

Railways and Their Accessories.

AIR-BRAKE SYSTEM.—A. I. PERRY, New York, N. Y. More particularly the invention relates to those systems in which the braking action is to be effective throughout a train consisting of a plurality of cars. Its principal objects are to provide means for simultaneously applying the brakes with a definite and controllable pressure and for securing an automatic application if the train parts.

METALLIC TRUCK FOR RAILROAD-CARS.—F. GEBHARDT, Alliance, Ohio. In this patent the object of the invention is to provide a new and improved metallic truck for railroad-cars formed of comparatively few parts, readily assembled, and arranged to insure an easy riding of the car-body of an exceedingly strong and durable truck.

FOLDING AND EXTENSION CAR-STEP.—J. S. COXEY, Aberdeen, Wash. One purpose of the invention is to provide a simple and readily-applied means whereby to simultaneously operate a folding extension car-step from the platform of a car and raise and lower the temporary platform which normally covers the steps and open or close the gate at the platform when a gate is employed.

Pertaining to Recreation.

MERRY SKATING-RINK. — H. LOISELEUR, New York, N. Y. This invention has reference to amusement devices such as used at pleasure resorts; and the object of the inventor is to produce an amusement device of simple construction which will have the general characteristics of a merry-go-round or carousel, but which will be used by persons upon skates.

PARLOR GAME. — J. A. S. CHEVOLLEAU, Kingston, Jamaica, West Indies. In this instance the invention pertains to parlor games and resembles the games of billiards and pool. The intention of Mr. Chevolleau is to produce a table upon which an amusing and interesting game may be played, the rules of the game being designed to put a premium upon accuracy and judgment.

Pertaining to Vehicles.

MEANS FOR UNITING A PAIR OF BICYCLES TO FORM A QUADRICYCLE.—C. H. NICHOLAS, 34 Stroud Green road, Finsbury Park, London, England. The object here is to provide means for connecting together a pair of bicycles (of any usual construction and motor or pedal or otherwise driven) side by side in such manner that the combination may constitute a single vehicle capable of carrying more than two persons, the device so provided being designed to enable the cycles to be quickly and easily united to form a quadricycle and to be as readily detached from one another, so as to permit of the ordinary use of either machine alone when desired.

COUPLING.—G. LLOYD, Gananoque, Leeds, Ontario, Canada. In the present patent the invention has reference to a coupling useful in various connections, particularly as a means for joining the parts of vehicle-springs and for connecting the thills of a vehicle to the axle-clips. With this coupling the thills are free to swing vertically; but the parts are prevented from side play, and wear may be taken up quickly by tightening a bolt.

Designs.

DESIGN FOR A BADGE.—F. BUSSE, New York, N. Y. This ornamental design for a badge shows an outspread "base ball fan," with the ball in the center of the fan, the whole mounted on a stick-pin.

DESIGN FOR EIDER-DOWN CLOTH.—C. H. FRENCH, Canton, Mass. This ornamental design for eider-down cloth consists of rows of squares of confused texture against a plain field of cloth. These blocks are separated one from another at regular distances of half the width of each.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.**

MUNN & CO.

Marine Iron Works. Chicago. Catalogue free.

Inquiry No. 8175.—For manufacturers of apparatus for testing purity, gravity and alcoholic strength of wines.

For logging engines. J. S. Mundy, Newark, N. J.

Inquiry No. 8176.—For manufacturers of public rifle ranges, especially the glass ball and water jet device.

"U. S." Metal Polish. Indianapolis. Samples free.

Inquiry No. 8177.—For address of Solar Furnace and Power Co.

Handle & Spoke Mchy. Ober Mfg. Co., 10 Bell St. Chagrin Falls, O.

Inquiry No. 8178.—For address of manufacturer of Benj. Keyes patent egg box or shipping carton.

American Manufacturers, etc.—Agencies wanted for Scotland or England. Blaikie & Co., Duns, Scotland.

Inquiry No. 8179.—For manufacturers of pressed zinc fruit jar covers.

I sell patents. To buy, or having one to sell, write Chas. A. Scott, 719 Mutual Life Building, Buffalo, N. Y.

Inquiry No. 8180.—For manufacturers of Edison's patent electric rat trap.

WANTED.—Architectural draughtsman, capable designer. State experience and salary. Hutchinson & Nobles, Regina, Sask, Canada.

Inquiry No. 8181.—For manufacturers of relief copying machine; also address of firm selling Dedrick-Wyon relief copying machines.

FOR SALE.—Water front in New York harbor with upland and riparian right. Address
X. Y. Z., Box 773, New York.

Inquiry No. 8182.—For manufacturers of prong brakes.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Machine Company. Foot of East 138th Street, New York.

Inquiry No. 8183.—Wanted, addresses of companies having experience in crude oil burners for annealing ovens.

Manufacturers of patent articles, dies, metal stamping, screw machine work, hardware specialties, machinery tools, and wood fiber products. Quadriga Manufacturing Company, 18 South Canal St., Chicago.

Inquiry No. 8184.—For manufacturer of McCall sleeping tent.

Automobile experts are in constant demand at high salaries. Our seven weeks' course is the most thorough and practical, fitting men to drive, handle and repair Day and evening classes. Special course for owners New York School of Automobile Engineers, 146 West 56th Street, New York.

Notes and Queries.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(10016) O. M. S. asks: 1. How may opaque objects be seen under the microscope? A.. By the use of the bull's-eye condenser. A lens which will focus the light of a lamp upon the upper surface of the object. One of these usually accompanies a microscope. 2. How can the glimmering of artificial light be overcome? A. If the light is too strong, turn the reflecting mirror till the field is illuminated to suit your eye. Shaded glasses can be had from dealers in microscopes which cut down and also color the light agreeably. These may be blue or gray. They are also made so that they are deeper in color in one portion than in another, and a nicer adjustment may be made of the illumination. 3. Will the best window or plate glass do for glass slips to use with a microscope of sixty-five diameters? If not, why? A. Any sort of glass will answer if it is smooth. It is better to buy the regular slips. These are 3 × 1 inch and are polished on the edges. They present a much better appearance than pieces of glass cut and left rough. 4. What proportion should the liquid, zinc and carbon be for a bichromate cell? A. A good bichromate mixture is composed of water 100 parts, potassium bichromate 17 parts, and sulphuric acid 10 parts, all by weight. The zinc and the carbon may be of any size which the battery jar will hold. It is better to have a carbon on each side of the zinc, two carbons to each zinc. This gives a larger current and utilizes the action on both sides of the zinc. 5. How to make an induction coil which will not induce a current strong enough to kill a person. A. A good induction coil is described in SUPPLEMENT, No. 160, price 10 cents. It is not necessary to injure one's self with a large coil. A simple rule for safety is to put the left hand in your pocket or behind your back when doing anything to the coil with the right hand, if the coil is running. 6. What are the preserving fluids used in the museums and laboratories? A. Alcohol is the fluid ordinarily used in museums for preserving specimens in jars and bottles.

(10017) L. F. S. writes to us as follows: I wish to know what horse power would be developed by a stream of water, which, if dammed would give a head of 130 feet or more. The amount of water flowing over a 4-foot weir is 8 inches, weir being rectangular 4 feet equals breadth, 8 inches equals depth. What size steel pipe or iron pipe would this water fill if it were to be carried to a turbine at distance of 1,200 feet? What is the cost of such pipe a running foot? Also, what would be the cost of a dynamo to utilize power thus developed by turbine? Suppose it were necessary to transmit power to a manufacturing plant at a distance of 4½ miles from power house. What would be loss of power in transmitting and what approximate cost of motor and wiring for such a plant? Kindly tell me where price list of motors and dynamos may be obtained. A. The capacity of your weir is 432 cubic feet of water per minute. This with 130 feet fall will give a theoretical power of nearly 3½ million foot-pounds or 112 horse-power. From this must be deducted the loss by friction and the water wheel which, if of the Pelton type, should net you 80 horse-power. The size of steel pipe for conveying this amount of water 1,200 feet with a loss of less than 2 feet head will be 24 inches in diameter and will cost about $1 per foot. A Pelton wheel and connections will cost about $400. The dynamo will cost about $2,400. A motor on a 4½-mile line will cost about $2,000, and should net 60 horse-power at 4½ miles distance. We refer you to the water wheel companies for estimates of a complete power plant.

(10018) Y. N. W. writes: As it is your aim to disseminate useful information we make the following statement which will interest all photographers: We recently purchased one of the new aluminium trays and lately undertook to intensify a negative in it, using a three-solution intensifier: Bromide of potassium, bichloride of mercury, and sulphite of soda, in the order named. Upon applying the mercury solution the chemical growth (which we had forgotten all about) of which a detailed description was given in the SCIEN-

TIFIC AMERICAN of March 10, 1900, immediately began, and we were unable to check it until to-day, when we happened to think of using muriatic acid. We immediately applied a dilute solution of the acid to the tray, using a cloth to take off the black coating. After rinsing we applied a solution of soda and other tests without any action of the mercury. We would, therefore, advise our brother photographers to never use an aluminium tray for intensification, but if they have already spoiled a tray by it to try the acid, which we think would prove effective in every instance. A. We suppose it is not possible that every one who has to do with chemicals should first study their chemical actions sufficiently to avoid the mistake of our correspondent of putting a chemical into his tray which would dissolve it. He knows the fact regarding aluminium now and is not likely to repeat the experiment. Experience is a good schoolmaster, though her instruction comes high, it has been said.

(10019) F. L. asks: 1. What causes the humming in electric street railway motors? They are noiseless when new, but after about six months or a year, they begin to hum. A. If this statement is true, we are not able to give a reason for it. There is no electrical cause which after this or any other period will develop a humming noise, nor any mechanical cause for such a universal effect. We suggest a broader investigation to see if all motors hum at the end of six months. 2. In cast-welding rail joints do they allow for any expansion or contraction? If so, how? A. No. If the joint is made stronger than the force of contraction, the rail will not break. If the rail is held down more rigidly than the force of expansion, it cannot break away from its fastenings. Hence, it will stay in its place both in winter and in summer. This is the theory. 3. Is there any direct incorporation of the metal in the rail and in the cast? I have heard some claim there is not, while others claim that the rail is fused at one or two points, generally about the size of a half dollar, where there is a direct union of the two metals. A. There is firm adhesion. We do not know whether there is incorporation or not of the two metals. 4. We have made a box-kite, with 2 cells, 16 inches long, and 15 inches square, with about 10 inches clear between them. When we try to set it up it will dive down, after going up about 25 or 30 feet, sometimes hitting the ground and breaking some of the sticks. A. We advise you to apply to the Weather Bureau at Washington, D. C., for the plans and construction of a box-kite.

(10020) J. B. P. asks: 1. Will you please advise me of some compound, or chemical, that will clean scales from a boiler, while boiler is in use, without any risk of burning the boiler, by water foaming? A. For keeping a boiler clear of incrustation there is nothing so easily managed as caustic soda or potash lye. Dissolve about a quarter pound of the soda or lye for each horse-power of the boiler in a barrel or tub of water and connect it with the suction of the feed water pump. Use the boiler for a day with the soda in. Then blow out from the boiler after the fires are drawn or banked or when the engine stops, to the level of the lower gage cock or bottom of water gage and pump up with fresh water to high water mark. Use the boiler next day as usual and at night after fires are drawn and walls cooled below the temperature of injury to the boiler, blow out all the water and clean out the boiler. This may be repeated according to the condition of the boiler, once or twice a month. See Davis' book on "Boiler Incrustation," $1.50 by mail. 2. Can I charge a set of storage cells by connecting them in series, in main circuit, batteries having the same capacity, in amperes and voltage, as the circuit, and will the batteries cause the lamps to burn dim? Would an ammeter connected in the circuit answer to tell when the batteries were charged? A. Connect the cells in series and to the line through the ammeter and a rheostat by which the amount of current can be adjusted. A good charging rate is 2½ amperes per square foot of positive plates, reckoning both surfaces. The final voltage should be 2½ volts per cell. This you must determine by a voltmeter in shunt with the cells. Stop the charging when this is reached. As you must put the cells in shunt with the lamps on the circuit, the charging of the cells cannot affect the light if the dynamo has capacity enough to charge the cells and light the lamps at the same time. A good book for one having charge of a storage battery is Treadwell's, price $1.75 by mail.

(10021) E. L. C. writes: Kindly inform me how to copper-plate—a good heavy plate. I wish to plate some steel and iron wire, 2 feet long and about 12 gage. I would also like to plate some wood a good heavy copper plate. I have tried a receipt from some book, but with little or no success, as the plate will not stay on the iron or steel when I rub or try to polish it, and some will not take at all. A. Your trouble probably is not due to the defects of the description in the book which you have followed, but to your own inexperience. The only way to become an electroplater is to learn the trade from some one who understands it practically. No description can prevent you from making mistakes, or tell you how to recognize the proper working of the process and the proper condition of the bath and the article to be plated. Had yours been all right, the coating would have formed properly and adhered. Such points must be learned by actual experience in actual work. We are not electroplaters and cannot teach electroplating. We recommend Watt's book, price $1.

(10022) G. A. H. asks: Can you give a description of a sketching camera that reflects direct from the photograph and not from a transparency or negative, and how to arrange the reflectors and lens in a lantern to do the same? A. We think you will find what you want in a "sketching camera" in Hopkins' "Experimental Science," price $5.00, by mail. He there describes a camera for projecting opaque objects, so as to project them upon a screen, as slides are projected by an ordinary lantern. If you place the screen where you wish the picture to fall as you sketch it, you will have a sketching camera for the direct use of a photograph, or any opaque object.

(10023) W. S. D. writes: I wish to make a storage battery large enough to light two 16-C. P. incandescent lights for a few months, several hours a day. I would kindly ask you to please give me your opinion as to which book to get for the construction of such a battery, and if you could give me some information, I would be very thankful to you. A. We can supply you with the following books on the storage battery: Salomon's "Accumulators," price $1.50; Treadwell's "Storage Battery," price $1.75. Prices are by mail. We do not, however, advise amateurs to attempt the construction of a storage battery for real work. It is well enough to make a few cells for experimental purposes. Amateurs cannot expect to make cells which will have much endurance or efficiency, as compared with the cells made in a properly equipped factory, and by experienced workmen. In your case you wish to light 16-candle-power lamps. These are rarely made for less than 50 volts. You will then need twenty-five cells with five or seven plates each. The cost will be very much greater than for the same amount of light obtained in some other way. The labor of making so large a number of cells is a great deal. You need as many cells as if you had a greater number of lamps. If you really must have electric lights from a storage battery, we would say buy the battery.

(10024) L. H. R. asks: 1. Does a static electric machine depend for its volume of electricity on the superficial size of plate or velocity, and will a sufficient series of plates at a greater speed give off very much electricity at a high speed on one large disk, at 200 or 300 revolutions? Please answer an old reader in query column next issue, to satisfy a difference of opinion. A. The discharge of a static machine depends upon several conditions, size of plate, swiftness of rotation, dryness of plates, absence of dust, etc. The spark cannot much exceed the radius of the plates in length, since it will find the distance less between the combs if the balls are separated more than half the diameter of the plates, and will pass between the combs, taking the axle of the machine on its way across. This is the reason for using as large plates as convenient. Glass is the best substance for the plates. Since there is a limit to the safe speed for glass, hard rubber is now used a great deal. This can be run at any speed desired, and a very strong spark can be produced. It is better to use several smaller plates than one large one, because of compactness and neatness of appearance. A well-made machine with two 18-inch plates of hard rubber, driven by a quarter horse-power motor, gives a steady stream of sparks at 1,800 revolutions per minute. It may also be driven by hand, though no one can maintain that speed very long. 2. Are mica plates superior to glass? A. Mica differs very little from glass in its inductive capacity, and would serve equally well for the plates of a static machine, if pieces of sufficient size could be had at a moderate cost.

(10025) F. A. V. asks: Please inform me how a small dry battery for a pocket search-light may be recharged from a 110-volt direct-current circuit. The batteries become exhausted very quickly, and it is rather expensive to be continually buying new ones, while I have the 110-volt circuit to draw from, where the minimum amount of current charged for is not being consumed. A. A small pocket dry battery is not worth recharging. They are thrown away when exhausted. To reduce a 110-volt current to 4 or 5 volts for this purpose would be very wasteful. A pocket search-light is a luxury which those who carry must be willing to pay for. The battery is never durable, and soon gives out whether used or not. It is usually overrated. 2. What resistance in the way of 16-candle-power lamps should be used in a 110-volt direct-current circuit to enable it to be used for electro-plating? What should the voltage and amperage be? A. The voltage for electroplating varies with the metal to be deposited. It is from 0.5 volt to 7 volts. The amperes depend upon the area of surface to be plated. The data are to be found in such books as Langbein's, which we send for $4, and Watt's, which we send for $4.50. 3. I have an ammeter whose limit is 20 amperes. How many lamps in series or parallel should be connected in the 110-volt circuit to obtain a reading on the ammeter? What is the resistance of a 16-candle-power lamp? A. If your ammeter does not register till 20 amperes are flowing, you will require forty lamps to make it indicate any current. The resistance of an incandescent lamp when hot is about 220 ohms.

(10026) G. W. asks: 1. What length of spark must my induction coil produce to make an X-ray apparatus for examining objects such as a leg or arm? A. A coil giving an 8-inch spark will answer for the thinner parts of the body, but for every kind of service one giving a 14-inch spark should be had. 2. What kind of tube would be the most suited for this work? A. There are many makers of tubes, whose advertisements are frequently to be found in our columns. A higher vacuum is required for use with a coil than for use with a static machine. All good tubes are now made with adjustable vacuum. 3. Can you give me directions for making a fluoroscope? A. You had better buy your fluoroscope.

(10027) J. E. P. asks: 1. How to remove the elements from a Hercules battery cell after the salts have crystallized, forming a solid mass of zinc, carbon, and jar. I have about a dozen cells in this condition, and it is impossible to get the elements out of the jars. A. We would suggest that you soak your cells in water, thus dissolving the crystals which have formed. This will be a slow operation. It will hasten matters to dig out all the crystals which can be got at with any sharp-pointed tool. Sulphuric acid will dissolve the substance more rapidly, but it will also consume the zinc, which you are probaby desirous of saving. In this case prevention is better than cure. 2. Can satisfactory results be got from compressed air in an ordinary steam cylinder, and how high a pressure is necessary per rated horse-power of engine to get best results? The best steam engine is also the best for compressed air. Only a very little higher pressure or longer cut-off is needed to give the same results for air as with steam for power.

(10028) J. L. C. asks: 1. Can you give details of construction of an acetylene search light that will project a narrow beam of light? A. An acetylene search light presents no peculiar conditions. Place the light in the focus of the reflector. Have the reflector adjustable so that it can be brought nearer or slid farther from the burner. You can adjust for best projection of the beam as may be required. 2. How would be the best way to reinforce the above light to increase the size of the burner, or to add individual burners? A. You cannot obtain all sizes of burner for acetylene. To increase the illumination you must add to the number of burners. They are usually placed tandem, and not abreast, when used for projection.

(10029) C. H. H. asks: 1. What kind of flux would you use for soldering platinum to copper, or a cement such as is used in incandescent lamps? A. Copper and platinum may be soldered together by the use of any ordinary flux and soldering tool. In making incandescent lamps, they are melted together by a blowpipe; that is, welded together. Carbons are attached to the platinum wires in a lamp by means of a cement whose composition we do not know. 2. What is the white powder used inside of cartridge fuses, and where can same be purchased? A. Any inert powder, not combustible, can be used in inclosed fuses. We have not anlayzed this powder in any fuse, and cannot tell what is used. 3. How would you calculate the amount of resistance to use on arc lamps for theatrical lighting purposes? A. Dimmers for theaters are probably designed by trial and experience. Make a variable resistance and cut in enough to reduce the lights to the lowest point desired, unless you would prefer to purchase a dimmer from the companies who already have the data for them in their posession. We should do this if we needed a dimmer. 4. Can an ordinary force pump be used for compressing air up to say 40 pounds per square inch? A. A force pump can compress air till the pressure equals the power of the pump to hold it, and then the pump will leak or burst. If the pump is strong enough, it will hold 40 pounds.

(10030) C. B. H. asks: Is it possible for the human eye to possess any of the features of a camera? I have noticed peculiarities about my own eyes being able to see objects a second time, after looking away from the object looked at, especially if in the shadow. The force of this lasts several seconds, being of greater strength with certain colors, etc. Will you have the kindness to answer this query, without reciting it in the columns of your paper? A. It is not a peculiar experience that you can still see an object before the eye after you have gazed intently at it for a brief time. Everybody can do the same. If you look at a colored object, say a bright blue, the object seen afterward will be a yellow. We call these objects seen after the object has disappeared, after-images, and the color presented by one of these is the complementary of the color presented by the object itself. Such an after-image will drift before the eye in a very curious fashion along a dimly-lighted wall, larger than the object if the wall be farther away from the eye than the object was, and smaller if the wall be nearer. This proves that the image is in the eye and is simply projected against the wall in the line of sight. You will find these matters discussed in books of physics under the name Accidental or After-Images. As you send no post-office address, but only your name, we can only reach you by publication of the information in our columns. We think too that the matter is of general interest, so as to justify its publication. Quacks often prey upon the fears of the nervous by means of these after-images.

(10031) C. L. K. asks: Will you please advise me through your query column how to get the various broken parts of the mercury column in a thermometer together after they have been separated in shipping? A. To reunite the parts of a broken mercury column in a thermometer, first try jarring it by taking it in the hand and striking the arm suddenly downward as if to give a blow with a hammer, being careful that there is nothing in the way of the arm which the thermometer can hit. If this does not accomplish the object, tie a sufficiently strong cord to the thermometer, and whirl it rapidly around the head. In this way centrifugal force and momentum may bring the mercury together. As a last resort cool the bulb in a freezing mixture, and contract the mercury till it is all in the bulb at the bottom of the tube. When the instrument warms again, the thread of mercury will be continuous. The break in the column of mercury is caused by minute air bubbles in the mercury and on the glass. These are pushed down by the mercury as it contracts into the bulb, and so the column becomes continuous when the mercury expands from the bulb again. If there is a small cistern at the top of the tube, the mercury can be heated till the broken portions are driven up into this cistern, thus accomplishing the same object as if the bulb is cooled.

NEW BOOKS, ETC.

FINANCIAL RED BOOK OF AMERICA. 1905 Edition. New York: Orlando C. Lewis & Co., 1905. 4to.; pp. 496. Price, $10.

This work is a list of the wealthy people of the United States, containing about 18,000 names of individuals and estates of wealth, giving office and residence addresses, business connections, and other details arranged alphabetically by States, subdivided by cities and towns. Those who wish to reach by correspondence or otherwise a wealthy class of people will do well to purchase a copy of this book. We have recently used this work successfully, and the percentage of unclaimed letters was so small that its accuracy seems assured. The book is edited by Charles D. Burbank.

THE PRINCIPLES AND PRACTICE OF IRON AND STEEL MANUFACTURE. By Walter Macfarlane, F.I.C. New York: Longmans, Green & Co., 1906. 12mo.; pp. 266. Price, $1.20.

The author treats his subject on original lines; for instance, the usual sequence is reversed, and the finished products are discussed first, while the treatment of the iron ore is developed toward the end of the book. The work is illustrated both by engravings and diagrams, and many of the twenty-three brief chapters will be found of value, including those on "Iron and Steel Castings," "Malleable Castings," and the "Testing of Materials." Valuable hints for the manufacturer are given in the appendix, such as the Analyses of Finishing Materials and Softeners, Typical Analysis of Pig Iron, etc.

THE APPLICATION OF GRAPHIC AND OTHER METHODS TO THE DESIGN OF STRUCTURES. By William W. F. Pullen. Manchester: The Technical Publishing Company, Ltd., 1905. 12mo.; pp. 341. Price, $2.

This book has been used by many engineers since the appearance of the first edition, and it has been found useful in many cases where the graphical methods are the only instruments needed by which particular numerical results are easily obtained. In the second edition the author has rewritten the chapter on "Struts," and has dealt with the question at greater length than in the earlier book. An appendix contains useful notes for the further elucidation of points in the original text.

GARBAGE CREMATORIES IN AMERICA. By William Mayo Venable, M.S. New York: John Wiley & Sons, 1906. 8vo.; pp. 200; 45 figures. Price, $2.

The municipal authorities of the United States are beginning to realize, though unfortunately at a late date, that the disposal of garbage and other municipal wastes is a question of the utmost importance, and, if properly executed, the handling of the wastes may be turned to pecuniary account for the benefit of the city. Mr. Venable's book is a review of the work that has already been done in the field of crematory construction, and it is based upon the actual inspection and the investigation of installations already in operation, and the analyses of the features of design, as set forth in patented inventions. The text includes many fully-illustrated examples of crematories in use throughout the country.

THE MORTON MEMORIAL VOLUME. A History of the Stevens Institute of Technology. With Biographies of the Trustees, Faculty, and Alumni and a Record of the Stevens Family of Engineers. Edited by Prof. F. De R. Furman. Hoboken: Stevens Institute of Technology. Half morocco; quarto, 663 pages, illustrated. Price, $10.

This book was originally planned as a souvenir of the twenty-fifth anniversary of the Stevens Institute of Technology. The late President Henry Morton of the Institute de-

voted much of his time to the collection of data and the preparation of illustrations for it at no little expense, and after his death the executive committee of the Alumni Association fittingly decided to make the volume a memorial to this eminent thinker and investigator, at the same time commemorating the period during which he was president of the college. The splendidly illustrated and printed book is a unique contribution to the history of engineering and engineering education in this country. The original plan of the work was somewhat changed when it was placed in the hands of Prof. Furman, its editor, and the section relating to the history of the Institute was considerably enlarged, while that dealing with the anniversary celebration itself was materially curtailed. To the engineer in general and to the student of science that part of the volume concerning the engineering work of the Stevens family, and of Col. John Stevens in particular, will prove of great interest. The limitations of this notice prohibit even a summary of the remarkable achievements of these pioneers in engineering, but it will surely be proper to say that no up-to-date engineering library is complete without an account of some of the work done by these investigators. The third section of the work is an admirable series of biographies of the trustees, faculty, and alumni, with complete lists of the writings of many of these, including the late Dr. Morton, and Profs. Mayer, Thurston, Wood, Leeds, Denton, Jacobus, and Pond.

MODERN STEAM ROAD WAGONS. By William Norris, A.M.I.C.E., M.I.Mech.E. New York: Longmans, Green & Co., 1906. 8vo.; pp. 172. Price, $3.

In this book will be found illustrated descriptions of many of the best-known makes of vehicles of the class discussed. Practically-written chapters on "Roads and Power Required," "Boilers," "Wheels," "Brakes," and "Steering" are given. The subject of boilers is treated in a practical manner, and the discussion is based on the author's personal experience. Many of the best-known kinds of wheels are illustrated, described, and criticised. The remarks on lubrication and the advice as to the choice of oils will be found of use by employers of steam wagons.

ADVANCED ALGEBRA. By Arthur Schultze, Ph.D. New York: The Macmillan Company, 1906. 8vo.; pp. 557. Price, $1.25.

This book is planned in accordance with the theory that a number of topics taught in the customary systems of advanced algebra may be omitted without injuring the courses. Some of these topics may be studied to advantage after the student is familiar with calculus. Consequently, the author has omitted a number of topics, for instance, multiple roots, Sturm's theorem, etc. In addition, numerous graphical methods have been included which are not found in the usual textbook, such as the graphical method for solving cubics. The examples given for solution by the student are excellent.

THE PRINCIPLES OF ELECTRIC WAVE TELEGRAPHY. By J. A. Fleming, M.A., D.Sc., F.R.S. New York: Longmans, Green & Co., 1906. 8vo.; 670 pp.; illustrated. Price, $6.60.

Since Marconi's first practical demonstrations of the possibility of wireless telegraphy, the literature of the subject has become fairly extensive, and includes a number of valuable writings. The present volume, by Dr. Fleming, undoubtedly one of the foremost of the English experts on electric wave telegraphy, is one of the latest and one of the best of these contributions. The volume is based largely on courses of Cantor Lectures delivered before the Society of Arts in London from 1900 to 1905. The author attempts to gather together the most important information resulting from the enormous research work carried out in the last ten years on the subject of Hertzian waves in their application to telegraphy; and while there is great difficulty in properly appraising the value of the numberless new schemes and appliances constantly being developed, nevertheless the fundamental principles are fairly well fixed, and the work will be found of assistance as a textbook, for it presents in compact form useful information, data, and formulæ.

EXPERIMENTAL ELECTROCHEMISTRY. By N. Monroe Hopkins, Ph.D. New York: D. Van Nostrand Company, 1905. Pp. 284. Price, $3.

The readers of the SCIENTIFIC AMERICAN SUPPLEMENT will be familiar with many of the points discussed in this excellent book, for the volume appeared almost entirely in that publication, a fact which the author fails to mention. The author begins with a brief historical review of the subject, and the student will find it of advantage to carry out some of the classical experiments described in the introduction. Extremely interesting is the author's strong presentation of the theory of electrolytic dissociation, which he supplements with numerous experiments to prove its truth. It is not possible here to describe the many different branches of the subject which the author treats at greater or less length; but the chapter on Electrolytical Induction is of particular value, as well as that on Electrolytical Conduction. The analytical discussion is very short, and will be useful more as a suggestion as to what can be done than as a guide for analytical purposes, for this is hardly a proper subdivision of the science. The book is well printed and splendidly illustrated with engravings which fully supplement the text, and it will be found of great interest to all those interested in electrochemistry.

THE DISPOSAL OF MUNICIPAL REFUSE. By H. de B. Parsons. New York: John Wiley & Sons, 1906. 8vo.; pp. 186; 73 figures. Price, $2.

The discussion of this excellent work by a practical consulting engineer is based upon the author's observations and records while in the employ of New York city, for the purpose of designing a plant intended for the disposition of municipal refuse. The information, which was collected at considerable trouble and at the expense of much time, is presented in a clear and concise form, and will be found of value to those undertaking to improve municipal conditions in this respect. The work is not a treatise on the designing of details for the final disposition of city refuse, but rather a compendium of the characteristics of the materials collected, the use to which they can be put, and the principles underlying their sanitary and economic handling.

AN INTRODUCTION TO ASTRONOMY. By Forest Ray Moulton, Ph.D. New York: The Macmillan Company, 1906. 12mo.; pp. 557. Price, $1.25.

Prof. Moulton presents a clearly-written and precise account of the present state of the science of astronomy. The work will be easily comprehended by the student or the amateur in the study of astronomy, as neither mathematical nor extensive scientific training is necessary to understand the principles and explanations set forth. The text is supplemented with a large number of excellent illustrations, which tend to make the subject discussed of great interest in a popular manner. In addition the author provides numerous suggestions and exercises for practical observations both with and without the telescope. In general, the book gives the reader a well-balanced and thorough general conception of the astronomy of to-day.

AN ELEMENTARY TREATISE ON PHOTOGRAPHIC METHODS AND INSTRUMENTS. By J. A. Flemer. New York: John Wiley & Sons, 1906. 8vo.; pp. 438. Price, $5.

This book has been written primarily with a view toward overcoming some of the existing prejudices against photographic surveying, and it does much to demonstrate that this branch of the science may rightly be assigned to a legitimate place in the curriculum of every modern photographer, filling as it does a particular gap in the general series of photographic methods heretofore recognized. Phototopographic methods are discussed for geological surveys, meteorological observations, hydrographic surveys, military surveys, etc. The book indicates in a general way how photography may be applied to topography by describing the simple processes and methods, particularly those of a graphic character, that will suffice to direct beginners in their practical application, leaving it to experience and subsequent special study to determine the measure of success.

MOTOR VEHICLES FOR BUSINESS PURPOSES. By A. J. Wallis-Tayler. New York: D. Van Nostrand Company, 1906. 12mo.; pp. 298. Price, $3.50.

It is hardly necessary to detail the advantages which the self-propelled vehicle for commercial purposes possesses over the methods of transporting heavy loads by means of horses. Not only is the subject already of vast importance to the manufacturer and the merchant, but its importance is constantly growing. The present book contains much valuable information to assist the purchaser or user of the motor vehicle to ascertain the respective merits of the various systems and their adaptability to special requirements. While a few of the various types of motors have been given extended description, the general survey of the subject is sufficient to supply the reader with a working knowledge of the systems involved.

HANDBOOK OF METTALURGY. Vol. I., Copper, Lead, Silver, Gold. By Dr. Carl Schnabel. Translated by Henry Louis, M.A. New York: The Macmillan Company, 1906. 12mo.; pp. 1,123. Price, $6.50.

While there are numbers of textbooks and treatises upon various subdivisions of metallurgy, it is a curious fact that there does not exist in the English language a single complete discussion of this tremendously important subject. This recent and most exhaustive work on the subject in any language is from the pen of one of the best-known metallurgical authorities of the world, and his many years' practical experience as a teacher and as an investigator in his own country and abroad, have given him especially favorable opportunities of studying metallurgical methods in general use in nearly all the countries of Europe and America. This is the second edition of the book, and it is as nearly up to date as it has been possible to make it.

IN THE HEART OF THE CANADIAN ROCKIES. By James Outram. New York: The Macmillan Company, 1906. 8vo.; pp. 466. Price, $2.50.

If we imagine the glorious scenery of Switzerland magnified many times in its extent, divested of the unpleasant features which the tourist hordes bring with them, and surrounded by and constituting a wilderness absolutely primeval, we see before us a picture of the Canadian Rockies. Mr. Outram has presented us with a splendid account of the beauties of this region. The illustrations, many of which are from photographs taken by the author, are beautiful. The lover of the mountains will find in this beautiful volume a story of travel and mountaineering that will make his heart ache for the freedom of pines and the snowclad peaks above them. The book is based upon series of articles which have appeared in various periodical publications.

ELEMENTARY ELECTRICAL ENGINEERING IN THEORY AND PRACTICE. By J. H. Alexander, M.B., A.I.E.E. New York: D. Van Nostrand Company, 1906. 8vo.; pp. 208. Price, $2.

This excellent little book gives the theory and practice of elementary electrical engineering, not only for junior and senior students, but for working electricians as well. It is based upon lectures delivered before evening classes of young artisans and, as will be understood, is consequently well adapted for the instruction of students possessing no extended previous knowledge of technical subjects. The illustrations, which include many diagrams, are very good.

THE LAW OF HEAVY AND LIGHT MECHANICAL TRACTION ON HIGHWAYS IN THE UNITED KINGDOM. By C. A. Montague Barlow, LLD., M.A., and Joynson Hicks. New York: Sir Isaac Pitman & Sons, Ltd., 1906. 12mo.; pp. 302. Price, $3.50.

With the growing use of mechanical means of transportation, and especially with the tremendous development of the motor vehicle, the legal problems involved are becoming more complicated every day. This book discusses at length, and with many cited decisions, the laws and acts governing the subject in England, Scotland, and Ireland, and is brought up to date by giving the motor car acts in force and discussing them in a general manner. Besides this, it contains in an appendix all the Local Government Board's orders extant.

A COMPENDIUM OF SPHERICAL ASTRONOMY. By Simon Newcomb. New York: The Macmillan Company, 1906. 8vo.; pp. 444. Price, $3.

The present volume is the first of a projected series having the double purpose of developing the elements of practical and theoretical astronomy for the special student of the subject, and of serving as a handbook for convenient reference for the use of the working astronomer in applying methods and formulæ. Prof. Newcomb's extended experience as a teacher at the Johns Hopkins University and as an independent investigator pre-eminently fit him for such an undertaking. His world-wide reputation as an astronomer gives all the recommendation necessary for his book.

DIRECTORY OF THE ENGINEERS' CLUB OF PHILADELPHIA. 1906. Corrected to April 7 inclusive. Pp. 123.

LUMINOUS BODIES HERE AND HEREAFTER. (The Shining Ones.) Being an Attempt to Explain the Interrelation of the Intellectual, Celestial, and Terrestrial Kingdoms, and of Man to His Maker. By Charles Hallock, M.A. New York: The Metaphysical Publishing Company, 1906. 12mo.; pp. 110.

MOTEURS A COLLECTEUR A COURANTS ALTERNATIFS. Par Dr. F. Niethammer. Paris: Edité par "L'Eclairage Electrique," 1906. 8vo.; pp. 129.

THE IRON AGE DIRECTORY. A Classified Index of Goods Manufactured by Advertisers in the Iron Age. Tenth Annual Edition. New York: David Williams Company, 1906. Pp. 317. Price, 25 cents.

TABLES FOR THE USE OF BLACKSMITHS AND FORGERS. By John Watson. New York: Longmans, Green & Co., 1906. 32mo.; pp. 88. Price, 90 cents.

THE ESTIMATORS' PRICE BOOK AND POCKET COMPANION. A Guide to Prices of all Kinds of Building Materials. With Handy Rules, Tables, and Information for the Estimator. By I. P. Hicks. New York: David Williams Company, 1906. 32mo.; pp. 172. Price, $1.

A NEW THEORY OF THE UNIVERSE. By the Rev. J. Cosand. Printed for the author by the Methodist Publishing House, Tokyo, Japan, 1906. 32mo.; 65 pp. Price, 25 cents.

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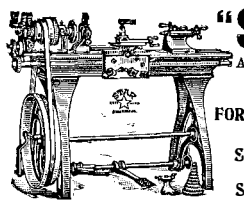

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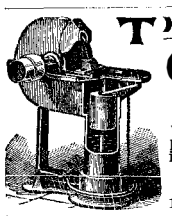

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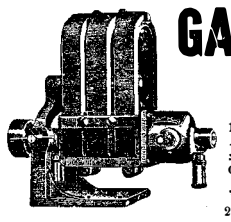

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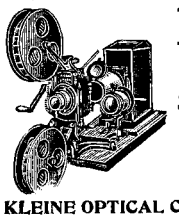

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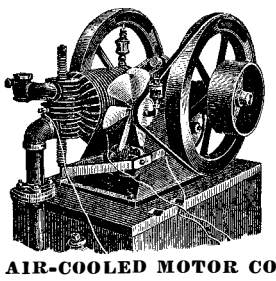

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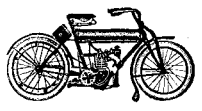

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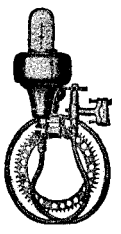

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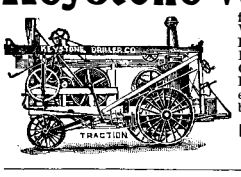

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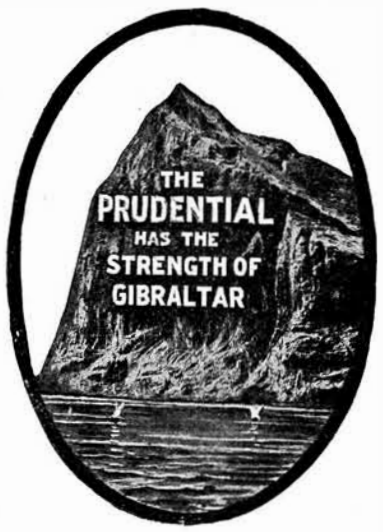

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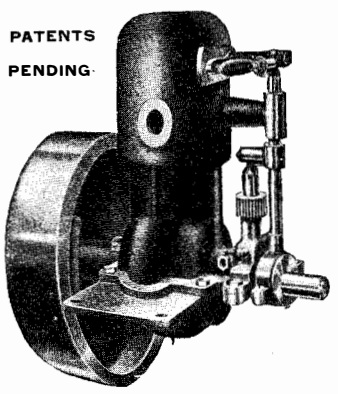

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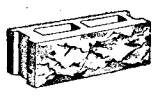

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Tea and coffee pots, Silver & Co.	53,794
Tea and coffee pots and urns, Silver & Co.	53,814
Telephones, Hutchinson Acoustic Co.	53,753
Tin culinary articles, Lisk Manufacturing Co.	53,776
Tires, pneumatic, B. F. Goodrich Co.	53,744
Tonic, digestive, and nutrient preparation, Charles N. Crittenton Co.	53,847
Tools and tool holders, certain named, Cleveland Twist Drill Co.	53,770
Typewriter ribbon, Bacon Brothers	53,771
Umbrella frames, Samuel Fox & Co., 53,898 to	53,900
Umbrella frames and ribs of metal, Samuel Fox & Co.	53,897
Umbrella frames, metal, Samuel Fox & Co. 53,896, 53,901,	53,902
Undershirts, drawers, and union suits, Deimel Linen-Mesh System Co.	53,898
Varnish, E. L. Hunter	53,660
Varnish coating for interior woodwork, liquid, Interior Hardwood Co.	53,661
Water, effervescent or carbonated mineral, Manitou Mineral Springs Co.	53,663
Water, mineral, Arondack Co.	53,743
Whips, Cargill Cleveland & Co.	53,803
Whisky, Chas. Shaffner & Co.	53,820
Whisky, H. J. Bellert & Sons	53,822
Whisky, O. J. Carpenter	53,841
Whisky, Mayer, Sons & Co. 53,861,	53,865
Whisky, E. A. McOuade	53,866
Whisky, J. M. Cranston	53,879
Whisky, George Bieler Sons Co.	53,880
Whisky, Kaufmann Bros. & Co.	53,885
Whisky, Kiefer & Co.	53,886
Whisky, Lazarus & Nassauer	53,887
Whisky, A. Loeb	53,888
Whisky, A. G. Marshuetz & Co.	53,889
Whisky, Maryland Distilling Co.	53,890
Whisky, Nelson Distilling Co.	53,891
Whisky, Strauss, Pritz & Co.	53,903
Whisky, Mayer, Sons & Co.	53,926
Whisky, rye, J. H. Hentz, Jr.	53,823
Wine, H. R. Myers	53,827
Wine, Wm. Hoelscher & Co.	53,874
Wine, Geo. Benz & Sons	53,914
Wines, To-Kalon Wine Co.	53,905
Worsted, woolen, and cotton-mixed piece goods, Griffon Co.	53,915
Wrenches, Mossberg Wrench Co.	53,665
Wringers, American Wringer Co.	53,742
Yeast, New Process Yeast Co.	53,759

LABELS.

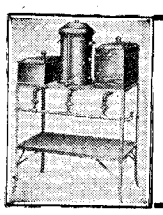
"A. No. 1," for tea, A. & G. Meyer	12,932
"Copalac," for a floor finish, Beckwith-Chandler Co.	12,935
"Elco," for a beverage, W. E. Riley	12,930
"Fire Chief," for a dry chemical fire extinguisher, Western Fire Appliance Co.	12,936
"Gay's Island Brand Clams," for canned clams, E. B. Hart	12,933
"Old German Lager," for beer, Wilmanns Bros. Co.	12,931
"The Virginia Brand," for pork products, Langdon & Boyd	12,934

PRINTS.

"Boys Indestructible Hose," for hosiery, Racine Feet Knitting Co.	1,698
"Composite Brick," for brick manufactured from a combination of sand, lime, and cement, L. Elkus	1,699
"Montreal Malt Rye," for liquors, N. M. Uri & Co.	1,696
"Tarita," for cigars, American Cigar Co.	1,695
"We Root for Fleischmann's Yeast," for yeast, Stahl & Jaeger	1,697

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co., 361 Broadway, New York.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list. For terms and further particulars address Munn & Co., 361 Broadway, New York.



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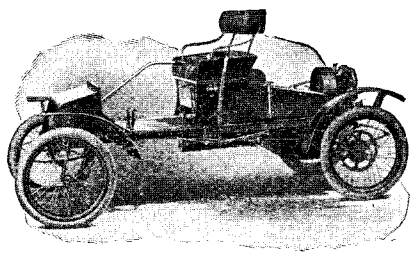

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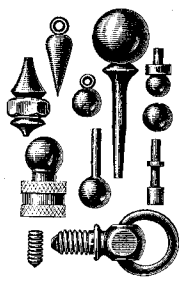

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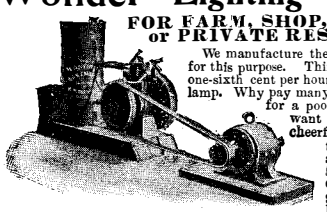

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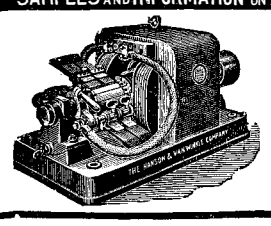

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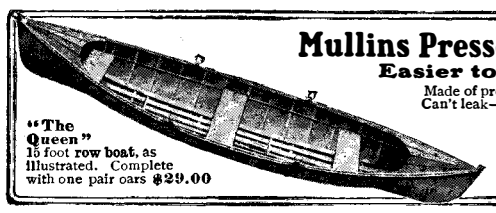

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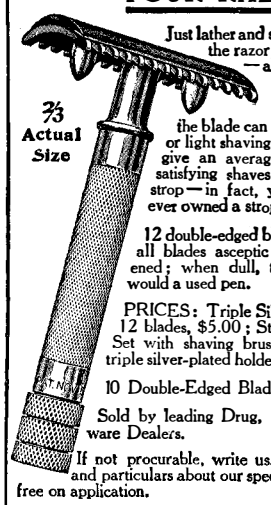

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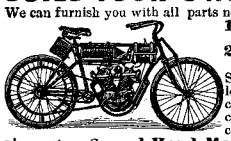

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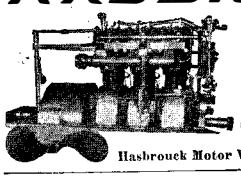

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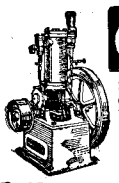

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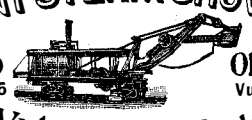

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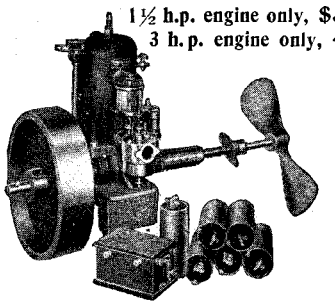

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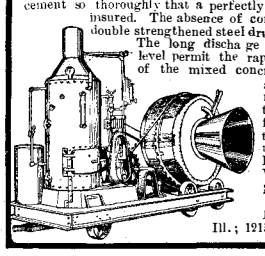

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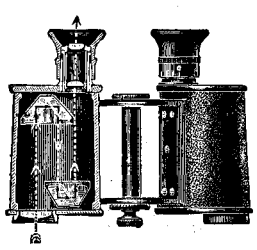

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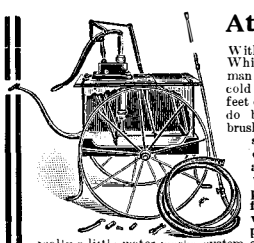

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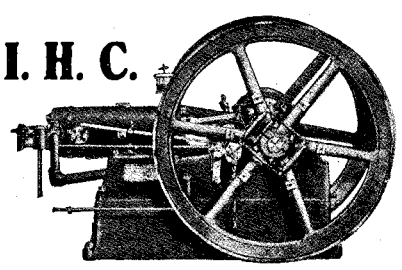

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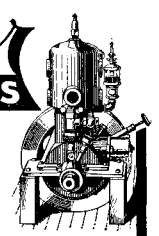

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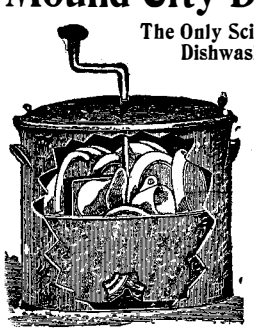

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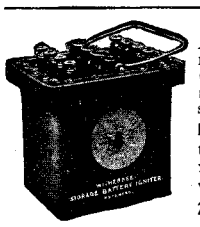

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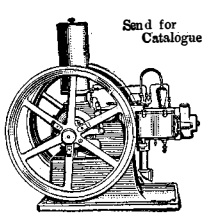

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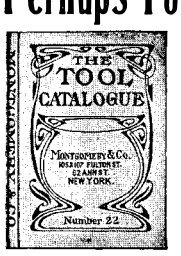

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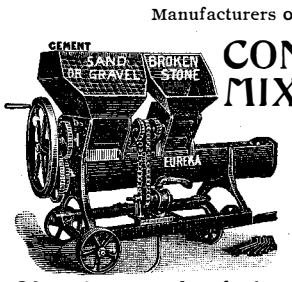

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